THURSDAY, DECEMBER 22, 1870

NATURAL HISTORY SOCIETIES

II.

IT must not be supposed that we expect, from Societies which have been but recently established, works of the importance or the completeness of those which we have mentioned * as emanating from the naturalists of Northumberland and Durham; or even such volumes as those annually issued by the Woolhope Club. It must be borne in mind that it is by no means necessary, or even advisable, that a young society should do much, or even anything, in the way of publication. The experiment of a local magazine has been tried in connection with more than one body, but in each case the results can scarcely be considered satisfactory. The Liverpool naturalists issued monthly such a publication—at first in lithograph, afterwards in print—which contained papers on subjects of general as well as of local interest. The High Wycombe Natural History Society started a similar magazine, on a similar plan, but issued quarterly instead of monthly; this continued for four years, but is now among the "things that are not." The Folkestone naturalists tried a like publication and with a like result; one year was sufficient to bring it to a close.

The failure of these periodicals is scarcely a thing to be regretted. The only scientific value of such local publications, it cannot be too often repeated, lies in the prominence given to local Natural History. It is not to be supposed that people even now, much less in the future, would refer to them for information—say on the Darwinian theory, or any other matter of general importance and interest—which would be found in fuller detail in magazines of wider circulation. Nor are popular descriptions of plants or insects of any greater value; and a physiological discovery of any importance should be communicated to some one of the many journals now open to naturalists. If such a discovery is recorded in a local publication, the chances are that it will be overlooked by the majority—simply because it is not in its proper place. The plea that Natural Science may be rendered more popular by such periodicals is worth but little; there are other magazines which, while wisely excluding local lists, are at once readable and scientific, and to them people really anxious to learn will turn for information.

The Folkestone Natural History Society has made a step in the right direction by publishing this year "A List of Macro-Lepidoptera occurring in the neighbourhood of Folkestone." This list occupies twenty-four pages, and is sold in a wrapper for 6*d*. As far as we know, this is the first of its kind; other bodies have issued local lists with their annual reports, but we have none published separately at a low price, like this of the Folkestone Society. The example is one which we hope will be followed; the funds of even a small field-club would be adequate to cover the expenses of printing, and the actual value to science of such a list is far greater than that of any number of local magazines containing papers of "general interest." The same society has in hand a list of the flowering plants of the district on the same plan, which will probably appear next year. The Belfast Naturalists' Club has this year issued with its report the first of a series of local lists; this has already been noticed in NATURE.

The system of dividing the labour of list-making, which is now coming into general use, may be regarded as a modification of the mode of working by sections, which we noticed in a previous paper. One or more members engage to superintend the making-out of some one list of the mammals, birds, lepidoptera, coleoptera, mollusca, fossils, phanerogams, or cryptogams. Each of these branches is, of course, capable of subdivision; and, where there are many workers, such subdivision is advisable. The Westmoreland naturalists have deputed one of their number to collect and examine the Batrachian Ranunculi of the district; and the investigation of certain "critical" genera and species might well occupy a careful observer for a considerable period. But we would lay especial stress upon the necessity of posting up regularly every scrap of information; books should be kept for the purpose, in which every discovery should be entered. By this means, and by this means only, can the actual state of the knowledge of any branch be ascertained; and it is easy to arrange for publication when required notes thus conveniently brought together. Whether for publication or not, however, and no matter how few and incomplete the records may be, it is the first duty of every Society, great or small, to register all its observations, not only for present benefit, but for the use of those who come after.

Although we would not urge upon every Society the "rushing into print," which is nowadays too common, we think we have reasonable grounds of complaint against one or two bodies, which have been established for some years, and number many members, in that they have not published more regarding the results of their labours. We may instance as an example the Manchester Field Naturalists' Society; and, as a notice of one or two of the more popular clubs falls within the scope of this paper, we may take this as a favourable specimen of them. Established ten years ago, chiefly through the energy of Mr. Leo H. Grindon, assisted by a few other Manchester naturalists, this Society soon counted its members by hundreds. At one time about five hundred and fifty names were enrolled, and, at the present date, between two and three hundred appear on its list. The work of the Society consists in the investigation, by means of excursions during the summer session, of the Natural History of the neighbourhood. These excursions are largely attended, and after the ramble the members assemble at tea, when addresses on scientific subjects are given. During the winter occasional *soirées* are held, which are rather too much like evening parties, with a little dilettante science thrown in; the room being decorated, extensive "toilettes" abundant, and instrumental music performed during the evening. The scientific "halfpennyworth of bread" to this "intolerable deal of sack" is provided by an exhibition of objects on a large scale, and the delivery of a paper or two, or a lecture, at some time during the proceedings. Of course, neither excursions nor *soirées* can be got up on this large scale without a proportionate outlay; and the result of this is that, although the annual subscription is 10*s*. 6*d*. —much too high, by the way, for such a body—the

* See NATURE, Vol. ii. p. 469.

balance in hand, when all expenses are paid, is inconsiderable. We do not wish to be misunderstood when we express our opinion, founded upon personal observation, that a large proportion of those who attend the summer excursions look upon them as merely pleasant afternoon rambles, and that of those who patronise the *soirées*, many go as they would to any other entertainment, without the slightest interest in Natural Science. There are good workers at Manchester—men, who from early youth have been strongly imbued with a love of nature, and who have done, and are doing, good service to science; and to their influence must be attributed the good effects which such a body certainly produces in spite of drawbacks. But, under the circumstances, it appears to us that instead of the somewhat lengthy, though interesting report, which is issued annually, containing detailed notices of the localities visited and papers read, which will be of little value to posterity, lists of the natural productions of the district, similar in plan to that published by the Folkestone Society, should be issued. One such list—that of the Mosses, by Mr. G. E. Hunt—appeared in 1864; and if only on the ground of showing that some real work is done, and of allowing the workers "fair play," a portion of the funds should certainly be devoted to the placing on permanent record, for the benefit of future observers, complete lists of the flora and fauna of the district. More especially at Manchester is such a record needed, inasmuch as the Committee advocate the establishment, "in places where they are likely to become permanently established," of plants foreign to the district, and of freshwater mollusca. This suggestion appears to us, under any circumstances, unadvisable; and unless some record is kept of such introductions, it must, if carried out, prove both misleading and injurious.

Those who contemplate the establishment of a field-club on a small scale will do well to content themselves with moderate beginnings. The subscription should be low—say *2s. 6d.*; patronage should not be sought, but rather discouraged; and every pains should be taken to show that no class distinctions would be considered of the slightest importance in matters connected with Natural History. In one society, with which we were intimately connected, we well remember the difficulty we had to convince an intelligent working man, with a genuine love for science, that he was a welcome addition to our ranks; and it is only by judicious management that such can be induced to co-operate with those who are considered their superiors.

The High Wycombe Natural History Society, another of those which has aimed at popularising science, holds monthly evening meetings during the winter at the houses of some of the principal members. These meetings partake somewhat of the nature of a *conversazione;* tea and coffee are handed round, papers are read, objects displayed, and the evening concludes with an exhibition of the microscope. Despite all care, however, the intention of these gatherings has been somewhat lost sight of, and they have grown to be looked upon as mild forms of dissipation. To remedy this, the plan is to be adopted of holding fortnightly, between the general meetings, instruction classes, which only those who are willing to work are expected to attend. Each of these will last from an hour to an hour and a half, and be devoted to some one special point; and the benefit resulting from this arrangement seems likely to be considerable.

A great point to be remembered by those who are engaged in organising a local Society is that it is by no means to be desired that a large number of members should be enrolled; in fact, when once the body is established, and its existence generally known, we would solicit no one to join it. Those who really care for the thing, and are therefore likely to be useful members, will come forward readily enough to lend a helping hand; but those whose assistance has to be sought will probably be of but little use, even if it be obtained.

The subject of local museums in connection with Natural History Societies is now exciting some attention; and we have intelligence of the recent establishment of one at Folkestone upon what seems to be a satisfactory basis.

*THE PHYSIOLOGICAL LABORATORY AT LEIPZIG**

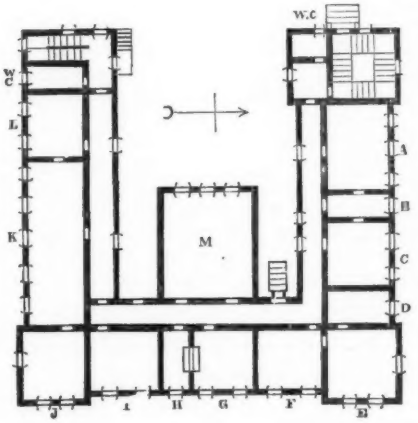
SINCE in England we have absolutely no physiological laboratory open to students, an account of the best in Germany (there are many others) will be interesting to the public. Perhaps some day the University of Oxford may think it desirable to erect such a laboratory to match that recently provided for Experimental Physics. There is plenty of money which the colleges could use for this object, if once they were freed from the old restrictions by the aid of the Government.

"The physiological laboratory, where I am at present working, owes its existence to the energy of Prof. Carl Ludwig, and to the liberality of the Government of Saxony. As it is universally acknowledged to be the most complete establishment of the kind in Europe, it seems to me to merit a somewhat detailed description. The building, as may be seen by the annexed plan, has somewhat the form of a horseshoe, with a small projecting portion in the middle, where the lecture-room is situated. The dimensions are—on the north and south sides, 119ft. 2in.: on the east side, 121ft. 11in. The right wing of the building constitutes the microscopical department, the left the chemical department of the laboratory, while the central portion is devoted to the study of experimental physiology in the narrower sense of the word.

"To describe the rooms more minutely. Room A is arranged for the accommodation of beginners in the study of microscopy, and is furnished with boxes that contain the microscopes, and a large ground-glass tablet, by means of which the lectures on microscopy are illustrated with drawings in coloured chalk. Room B is the private study of the assistant in microscopy. Room C is intended for more advanced students in microscopy, and contains an injecting apparatus, by means of which three different fluids can be injected simultaneously under any required pressure and for any length of time, while the injection mass and the tissue to be injected are heated over a water bath. Room D contains a small library, consisting of such books as are most needed for constant reference. Room E is furnished with glass cases, in which physiological apparatus is kept when not in use. As a rule, no experiments

* From the *Boston Medical and Surgical Journal.* Letter from Dr. H. P. Bowditch.

are performed in this room. Rooms F, G, and H are devoted to experimental physiology, and are furnished with operating tables, with bellows attached for keeping up artificial respiration on curarised animals, registering apparatus of various sorts for recording the pressure of the blood, water baths where any required temperature may be kept up indefinitely, an injecting apparatus like that in the microscopical department, evaporating closets, glass cases for apparatus, &c. Between Rooms G and H is a small closet arranged for observations with the spectroscope. Room I is the chamber where all experiments are performed which require the use of large quantities of quicksilver. It contains two quicksilver pumps for extracting gases from fluids, instruments for measuring the activity of the respiration in man and the lower animals, &c. Room J is divided into two portions, one of which is used



for a weighing room, and the other for experiments in acoustics. Rooms K and L contain, besides the ordinary furniture of chemical laboratories, the ingenious air-pump of Bunsen, by which the process of filtering is so greatly accelerated. The lecture room, M, accommodates about one hundred students. Tables running on a small railroad in front of the seats, enable the lecturer to demonstrate his experiments very conveniently. The room is lighted from above as well as from the side, and if necessary, can be darkened completely for optical experiments. In the basement of the building is a small gas-engine of about one-horse power, which drives the respiration apparatus, registering instruments, &c. In the basement are also the rooms where the animals are kept (one room being devoted entirely to frogs), a chamber furnished with refrigerators for performing chemical experiments, where a low temperature is required, a chamber containing furnaces for fusion, a workshop, store-rooms, &c.

"The second story of the building contains the rooms of Prof. Ludwig and his family, and those of other persons connected with the laboratory. In the court-yard is a small building containing the necessary arrangements for experimenting on horses and other large animals. Here, also, are an aviary and a small fish-pond.

"Besides the permanent and stationary apparatus already described, the laboratory is well supplied with all sorts of instruments for physiological experiments, and new apparatus is constantly ordered for special investigations. There is also a very skilful mechanic living in the laboratory, whose duty it is to make alterations or repairs in the apparatus as circumstances may require.

"Prof. Ludwig directs personally all the work done in the laboratory, devoting his whole time to the superintendence of his pupils, and making no independent investigations. Each of the pupils, at present nine in number, makes, under the direction of the Professor, a series of experiments with a view of settling some special point in physiology. The results arrived at are published at the end of the year, sometimes under the names of the Professor and pupil together, and sometimes under that of the pupil alone. The whole work of the laboratory forms every year a pamphlet of 150 to 250 pages.

"Prof. Ludwig lectures five times a week on physiology, and his assistants, viz., Prof. Schweigger-Seidel in microscopy, Dr. Hüfner in chemistry, and Dr. J. J. Müller in physics, also lecture on their specialties, besides superintending the work done in their respective departments.

"It will thus be seen that abundant facilities are here offered, not only for learning the existing state of physiological science, but also for becoming familiar with the manner in which physiology is at present studied in Germany. The patient, methodical, and faithful way in which the phenomena of life are investigated by the German physiologists not only inspires great confidence in their results, but encourages one in the hope that the day is not far distant when Physiology will take its proper place as the only true foundation of Medical Science.

"H. P. BOWDITCH."

Dr. Bowditch adds to this in a private note that *all* expenses, even down to the frogs used for experiments, are borne by the Saxon Government; so that the institution is absolutely free of charge to the student. Professor Ludwig welcomes to the laboratory any student—provided there is room for him—whether German, English, French, or Russian, who is desirous and capable of original investigation.

PALÆONTOLOGY OF MAN

Précis de Paléontologie Humaine. Par le Docteur E. J. Hamy. 8vo. (Paris, 1870. London: Williams and Norgate.)

M. HAMY'S Palæontology of Man, written with the view of bringing the results of recent discovery to bear on the antiquity of our species, is a most important contribution to the rapidly increasing literature of prehistoric archæology. It is intended to serve as an appendix to Sir C. Lyell's great work on the subject, and treats only of palæolithic man to the exclusion of the three newer prehistoric ages. M. Hamy has classified his materials with judgment and caution, and has collected into a small compass most of the statements on record of the existence of man in the geological past, with a running criticism, which sometimes admits, and at other times rejects, the testimony. He stands almost alone among his countrymen in attaching no importance to the reputed discovery of the famous Moulin Quignon jaw, and in allowing that the circumstances under which it was found were, to say the least, very equivocal. His book, in a word, is so good that I propose to draw attention to a few of the weak rather

than the strong points. Among the latter, the first chapter, which treats of the employment of stone implements in the religious ceremonies of the ancients, and gives the history of "thunderbolts," is perhaps that which especially demands the notice of the English reader.

The evidence adduced by M. Bourgeois of the discovery of flint flakes and scrapers in the Miocene strata of Thenay, along with remains of the hornless rhinoceros and mastodon, proves, according to M. Hamy, that man was an inhabitant of Miocene Europe. It is, however, rejected by most of the French and English *savants*, because M. Bourgeois has not shown that the implements in question may not have been derived ultimately from the surface of the ground, where they are very abundant. While M. Hamy acknowledges this to be the case, he does not see its full bearing on the value of the testimony. The implements probably are of Quaternary, or even of post-quaternary age, and certainly cannot be considered decisive of the sojourn of man in Europe during the Miocene epoch, although the climate at the time was almost tropical, and the conditions of life easy. Nor can the evidence of the grooved bones of Halithere, found by M. Delaunay at Puancé in Maine-et-Loire be accepted, because it cannot be proved that the grooves may not have been caused by some other agency than that of man. The proof of the existence of man in Europe during the Pliocene epoch derived from the striæ in the fossil bones found at Saint Prest and in the valley of the Arno, accepted by M. Hamy, is equally unsatisfactory. The flint "arrow-head" (fig. 25) and other rude fragments said to have been obtained at the former place from the same horizon as the bones of *Elephas meridionalis*, by M. Bourgeois, the stout champion of Miocene man, do not afford the precise and exact testimony which is demanded for the establishment of the case. The presence, indeed, of man in Europe in the Miocene and Pliocene epoch is as yet non-proven, and we must be content to await future discoveries. The results of the labours of archæologists and geologists throughout Europe during the last ten years has not placed the advent of man further back than the river gravels of the Somme, and the epoch of the caves, both of which are post-glacial or post-pliocene, or quaternary, in other words posterior to the great submergence and refrigeration of northern Europe, through which many of the Pliocene mammalia were destroyed.

M. Hamy has done good service to the students of the Quaternary epoch by refusing to allow the validity of M. Lartet's divisions into the age of extinct animals, as distinguished from that "of those which have migrated." The intimate association of the remains of the two groups in the caves and in the river-deposits, renders such a division untenable. He also modifies the divisions of the Quaternary invented by M. Lartet—(1) the age of the cave-bear, (2) that of the mammoth and woolly rhinoceros, (3) that of the reindeer, and (4) that of the aurochs, by running the first and the last two into two groups, connected together by a series of transitions. In other words, in the application of M. Lartet's system, he finds it necessary to admit that the "ages" are more or less connected together, and have no very great value in classification. M. Lartet was undoubtedly correct in the view that the post-glacial or Quaternary mammals did not arrive in Europe *en masse*, but he has not shown us the order of their appearance, which is the very corner-stone of his system. So far as the geological evidence goes, the aurochs was probably living in the Val d'Arno in the Pliocene age, and the reindeer is found as abundantly in France, Germany, and Britain with the cave-bear as with the mammoth and woolly rhinoceros. Since, indeed, the Quaternary epoch succeeded the great lowering of temperature, it might, *a priori*, be inferred that the reindeer was one of the first animals to invade the then almost arctic regions of Central and Northern Europe. The caves, however, and the river-deposits, reveal nothing on this point; they merely prove beyond a doubt that all the Quaternary mammals were living here at the same time. It is very hard to understand why M. Lartet should have expected to find all the species of animals in one locality, and should have based his classification on the absence of some, and the presence of others, since in every living fauna the animals are unequally distributed. Nor is there any intelligible cause why some few animals should be picked out of a large fauna to the prejudice of the rest, for classificatory purposes. The Essay on the Post-glacial Mammals of Great Britain (Quart. Geol. Journ. 1869) demonstrated that the system will not apply to the British Fossil Mammalia, and M. Hamy's book implies that it is equally inapplicable to those of France, for which it was intended. It is not too much to say that our present knowledge forbids any attempt to subdivide the Quaternary epoch by an appeal to the animals living at the time. Archæologists may perhaps be able to classify the different forms of implements, but naturalists are as yet unable to learn the order in which Quaternary mammalia invaded Europe. The reindeer is quite as likely to have preceded as to have succeeded the mammoth.

W. Boyd Dawkins

COOKE'S CHEMICAL PHILOSOPHY

First Principles of Chemical Philosophy. By Josiah P. Cooke, Jun., Erving Professor of Chemistry and Mineralogy in Harvard College. Pp. 533. (Macmillan and Co., London and Cambridge, 1870.)

THIS book is intended to be used by students who have attended lectures on experimental chemistry, or after a course of laboratory instruction; hence it deals merely with the theoretical principles of the science and their application for the solution of many practical problems of chemical research.

Every chapter and section is followed by a series of problems and questions which the student is recommended carefully to work out, and anyone who has mastered all the problems set forth will have attained a very considerable proficiency in chemical science.

In the introductory chapter we have definitions referring to volume and weight, and the author has adopted here, as in several other instances, different kinds of type in order to represent different relations. Thus, Sp. Gr. in italics means specific gravity referred to water as unity; the same symbol in ordinary Roman letters signifies that hydrogen is taken as the standard; and when printed in Old English type that air = 1. The distinctions between chemical and physical forces are here pointed out.

This chapter is concluded by twenty-three problems and questions referring to weights and measures and specific gravities. Throughout the book temperatures are expressed in centigrade degrees, and the metrical system is employed. Next, we have chapters on fundamental chemical relations and molecules, and the relations of the latter to heat. Chapter IV. treats of Atoms, and Chap. V. of Chemical Notation. Under this head we observe several definitions and modes of formulation which are not usual in this country. Thus chemical reactions are divided into three classes, analytical, synthetical, and metathetical, the latter including double decomposition, displacement, and re-arrangement. The symbols are usually printed in italics, but solid bodies are formulated in "full-faced" type, and gases in skeleton type; and when reactions take place in aqueous solution this is expressed in the equation by including the dissolved bodies in brackets with the symbol *Aq*: thus, $(Ca\ Cl_2 + H_2O + Aq)$ shows that the calcic chloride is in solution, and that the quantity of water represented by H_2O is a result of reaction. In the chapter on Stochiometry (though Stoichiometry seems more correct) are a number of modes of calculation of formulæ, and of the relations between weight and volume; and under Chemical Equivalency is a kind of constitutional formulæ which somewhat differs from those in general use. Professor Cooke follows the principle laid down by Dr. Frankland that chemical formulæ should represent, as far as possible, the relations existing between the atoms of a compound; but he has thought it advisable to place the grouping element or radical at the end of the formula instead of the beginning; this, we think, is to be regretted, as it adds another to our already numerous modes of formulation. Short strokes are placed at the side of the grouping element or radical to indicate the direction of the attractions; thus the formula for Ethylacetamide is $H, C_2 H_5, C_2 H_3 O \equiv N$, showing that the hydrogen, ethyl, acetyl, are united directly to the nitrogen, the commas indicating that they are not united among themselves: Diethylurea $H_2, (C_2 H_5)_2, \equiv N_2 = C O$ is another instance. When these short strokes become numerous they are rather confusing, as in Turquoise, $O_3 \equiv [Al_2]_2 \equiv O_6 \equiv (P O_2)$. Graphic formulæ of Kekulé's and Crum Brown's form are explained, and students are advised to make frequent use of them, but not to abuse them. The nomenclature employed is that which is frequently used in England, and which Mr. Cooke designates as that of the London Chemical Society, though we think that some of the Fellows disapprove of such terms as zincic sulphate, &c. The physical relation of chemical bodies, as crystallography, electrolysis, spectrum analysis, and heat of chemical combination, are treated at some length. The elements are divided into sections according to their atomicity, the perissads being taken first and afterwards the artiads. This arrangement places oxygen beyond the middle of the book, instead of near the commencement as usual. The occurrence, mode of preparation, and properties, of the elements, and of their more important compounds, are very concisely given. Carbon is described as occurring in three forms, diamond, graphite, and *coal*. This last term seems an unfortunate one for amorphous carbon, as some coal contains as little as 73 per cent. of the element. Under the compounds of carbon is a section on Organic Chemistry which extends over only sixty pages Although it contains a vast amount of information, and organic compounds are mentioned throughout the book, yet it seems rather a meagre account of the enormous developments of this branch of science. At the end of the book are tables of French measures and weights, of elements, of the specific gravities of gases and vapours, and of logarithms and antilogarithms. We wish this book success, as it indicates great vitality in Transatlantic chemistry.

OUR BOOK SHELF

Elementary Treatise on Natural Philosophy. By Professor A. Privat Deschanel, of Paris. Translated and edited, with extensive additions, by Prof. Everett, D.C.L., of Belfast. In 4 parts. Part I.—Mechanics, Hydrostatics, and Pneumatics. (London: Blackie and Sons.)

THIS translation of Prof. Deschanel's "Traité de Physique" will, we believe, be found extremely useful. An elementary treatise of moderate size on Physics has been long wanted in our schools. Atkinson's translation of Ganot, or Brook's Natural Philosophy, is too expensive for general use, and of smaller books, none, so far as we know, are good. The issue of Dr. Everett's translation in parts at the moderate price of 4*s.* 6*d.*, will enable it to be largely employed. The engravings with which the work is illustrated are especially good, a point in which most of our English scientific works are lamentably deficient. The present part contains Mechanics, Hydrostatics, and Pneumatics. The clearness of Deschanel's explanations is admirably preserved in the translation, while the value of the treatise is considerably enhanced by some important additions. Thus, to Deschanel's description of the pendulum is added a short account of the condition of isochronous vibration, moment of inertia, momentum, and kinetic and potential energy. In the section on Pneumatics, Deschanel's extremely good description of the air-pumps of Hawksbee, Bianchi, Kravogl, Geissler, and Deleuil, is supplemented by an account of Sprengel's mercurial pump. It is possible to point out defects, but they are few. The conception of "mass" is always a difficult one for a beginner. Deschanel gives a very clear explanation, which is not reproduced, the term being employed without explanation. Nor do we understand why, instead of Deschanel's statement that the co-efficient of absorption of ammonia in water at O°C. is 1050 (exactly it is 1150), it is said to be only 600. But these are minor defects, and we repeat that we believe the book will be found to supply a real need. W. M. W.

The Wild Garden; or, Our Groves and Shrubberies made beautiful by the Naturalisation of Hardy Exotic Plants. By W. Robinson. (London: Murray.)

THIS little volume forms a fitting sequel to Mr. Robinson's admirable book, "Alpine Flowers for English Gardens," which we noticed some time back.* It does not contain nearly such a large amount of novel information, but will nevertheless be of great value to all lovers of their gardens. The book is a protest against the practice which commenced some twenty years since, and reached its height a year or two back, of throwing the whole energies of the gardener into producing large masses of colour by the use of what are termed "bedding plants," to the exclusion of the cultivation of the individual flower. This somewhat barbaric taste has resulted in the gradual disappearance from our gardens of many flowers which had been "household words" since the time of Shakespeare, to the great detriment, as Mr. Robinson considers, of gardening as a real art, and to the enormous increase of its expense.

* NATURE, vol. i. p. 603.

Our great traveller and naturalist, Mr. Wallace, says, that "during twelve years spent amidst the grandest tropical vegetation, he has seen nothing comparable to the effect produced on our landscapes by gorse, broom, heather, wild hyacinths, hawthorn, and buttercups." Mr. Robinson's aim is to make our gardens as beautiful as our hedgerows and woods; and to this end he would not have his favourite plants placed together indiscriminately in a bed; but, as far as possible, he would imitate the natural *habitat* of each species, and for this he gives full instructions in each case. Half the volume is occupied by a list of hardy exotic plants suitable for naturalisation in our woods, semi-wild places, shrubberies, &c., with directions for their cultivation; and we hope it may assist in again bringing the public taste to the culture of flowers beautiful not only in themselves, but from the historic associations connected with many of them. A. W. B.

Die Kleinschmetterlinge der Umgegend Münchens und eines Theiles der bayerischen Alpen. Von August Hartmann. 8vo, pp. 96. (Munich, 1871: E. Lotzbeck.)

THIS is a catalogue of the Micro-Lepidoptera of the neighbourhood of Munich, and of a portion of the Bavarian Alps, with indications of the plants on which the larvæ of the different species have been found feeding and of the times and places at which the species have occurred. In his Introduction the author describes the method which he adopts for killing and preparing the delicate little moths which form the subject of his book, and from this the collector of Micro-Lepidoptera may gain some important hints. He also notices especially the curious moths belonging to the group of Psychidæ, and those Tineidæ which resemble them in habits; and he fully confirms the statements of Von Siebold as to the occurrence of parthenogenesis in *Solenobia triquetrella* and *lichenella*. W. S. D.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

Eozoön Canadense

IT is now about five years since a series of communications to the Geological Society of London by Logan, Dawson, Carpenter, and Sterry Hunt, announced the discovery of organic remains in the Laurentian rocks of Canada. They were decidedly interesting, not only as attempting to show that the belts of limestone interpolated in the great beds of Laurentian Gneiss were organic in their origin, but also from the *art* which the authors displayed in the mode of placing their views before the public. The realistic manner in which the fossil *Eozoön canadense* is drawn as it were from the *life*, coupled with the fixed belief in most men's minds that limestone is necessarily organic in its origin, predisposed many to accept the theory without much inquiry. The reputation of Dr. Carpenter as a physiologist was alone considered sufficient to settle the matter. These views did not, however, long remain unchallenged, for in the following year Professors King and Rowney, in a communication "On the so-called Eozoönal Rock," detailed the elaborate investigations by which they arrived at the conclusion that the presumed fossil was purely a mineral production. The replies that naturally followed were literally little more than reiterations of previous statements, excepting in the important admission from Dr. Carpenter, that the several features (that is chamber casts, canal system, and proper walls) could be separately paralleled elsewhere. He, however, took his stand upon the combination of the whole found in the Canadian specimens. To the fatal objection that all had been obtained from metamorphosed rocks Dr. Dawson replied by producing a specimen from Tudor, Ontario, which Sir W. E. Logan goes no further than to declare is from *comparatively* unaltered limestone, but which Dr. Dawson considers furnishes a conclusive answer to all arguments drawn from metamorphism. Since then I am not aware that any further evidence in favour of the organic hypothesis has been made public. On the other hand, Professors King and Rowney announced in a paper, read before the British Association at the Liverpool meeting, that they had discovered the features of the so-called organism in the Ophite of Strath in the Isle of Skye, an altered sedimentary deposit of the Liassic age, in which evidence of its mineral origin was conclusively proved. Here, at present, the matter rests; but in my opinion ample materials exist for forming a judgment, not by reliance on authority but by independent reasoning. With this object in view, and with your permission, I will proceed to detail a few of the facts of the case. Before doing so I would, however, call attention to the strange absence of any allusion to obvious objections which characterises the first series of papers, and to the persistent begging of the question involved in constantly speaking of the specimens as undoubted fossils. The adoption of this objectionable practice under authority of such eminent names is prejudicial to an impartial judgment, as it indirectly influences the mind. I am quite willing to admit that there existed sufficient reasons for suspecting them to be fossils, but I submit that it is not philosophical to state so distinctly before a thorough examination of all the objections. For evidence of this having been done I search these papers in vain. How then can any one, accustomed to scientific methods of investigation, help suspecting that under all this scientific and pictorial use of the imagination there exists or lurks a fallacy?

First, then, the specimen from Tudor has to be disposed of; nor will this be difficult, for it is altogether a lame affair. It is admittedly not from an unaltered rock, so it is difficult to see even how it bears on the question. The distinctive features are also obscure, and the chambers not of the usual form and proportion. To call this *Eozoön canadense*, and then bring it forward as closing the discussion, is an amusing piece of controversial skill. When it is more certainly co-ordinated with the original specimens, it will be time to discuss it. I simply ask, would it have been pronounced organic had it been the only variety discovered? I think not.

The broad fact then remains unshaken that in unaltered rocks no Eozoönal structures have yet been discovered. On the other hand, in metamorphosed rocks such structures are abundant, and even Dr. Gümbel, of the Bavarian Survey, a believer in Eozoön, has been much mystified by finding its features in impossible places. Not only do we find it in the Laurentians, but in rocks of a much later date, but curiously only in those that have undergone alteration. If it be an organism, then hydrothermal action, it seems, is necessary to its development, not as one would suspect during life, but ages after its entombment in sedimentary deposits.

The prevailing infilling material of the "chamber casts" representing "the sarcode body of the animal," is also admittedly serpentine or some analagous mineral—a mineral that forms the basis of no known fossil, consequently we are to assume that at each period of the animal's existence, either the conditions were different to those under which others were fossilised, or that the original infilling has since been replaced by serpentine; and this, be it said, must always have happened in those rocks afterwards selected for metamorphism.

Again, as minerals of this description are never found in unaltered rocks, we must be prepared to believe in the curious coincidence of the same rocks, and only these, having, at periods widely separated in point of time, been selected for the preservation of the organism and the deposit of these minerals. Either we must do this, or be prepared to show that metamorphism must necessarily change the infilling of the "chamber casts" to serpentine. Which supposition is the wildest?

Still further, we must believe that not only has Nature so miraculously preserved her pet animal, but that she has also imitated the fossil organism in the same minerals in an altered rock, in a manner to justify such acute observers as Professors King and Rowney in considering the imitation identical with the thing itself. For in the altered portion of the rock at Strath, before referred to, we have the features of the Eozoön, while the unaltered portion, which it gradually shades off into, teems with characteristic Liassic fossils. Have these fossils been obliterated in the altered portion, or have we the Eozoön again conterminous with the metamorphism?

And, in conclusion, we must further admit that all these conditions have been fulfilled over wide areas and at periods remotely separated with unerring regularity whenever the Eozoön has made its appearance. Is not this an improbability amounting to the impossible? For my part, this negative evidence far

outweighs the "determination of its foraminiferal affinities by a point no larger than a pin's head," and I feel assured that whenever impartial geologists take the question up the fossil itself will become extinct.

T. MELLARD READE

Blundellsands, Liverpool, Dec. 12

The Difficulties of Natural Selection

MR. WALLACE'S frank acknowledgment, for which I thank him, that he had in his two previous letters misunderstood my line of argument in what I consider one of the most important points at issue between us, absolves me from the task of again defending myself from charges of error and self-contradiction. As, moreover, Mr. Wallace has not accepted my challenge "to explain the nature of the intelligence which was operative in the creation of man, and which is a principle unknown in the rest of the organic world," it is impossible to pursue further this branch of the question. All naturalists will look forward with the most intense interest to Mr. Darwin's long-promised work on Natural Selection as applied to Man. There are, however, one or two subsidiary points raised in the discussion, to which I shall be glad of the opportunity of briefly referring. Mr. Stebbing, objecting to my attempted parallelism between mimicry and instinct, says that "it can hardly be said to be proved" that the extraordinary resemblances occasionally found in the vegetable kingdom are not protective or mimetic. I certainly think it can be. When we find an almost absolute identity between the foliage of a plant belonging to Africa and another growing in South America,* we are certainly justified in saying that one has not imitated the other, and that it gains no protection from the resemblance. Mr. Carvalho again makes merry over what he calls "my" argument, that imperfect imitation is, to all appearances, not beneficial in the cases published by Mr. Weir. The argument is not mine. I simply recount the observations made by practical entomologists, undertaken at the suggestion of Mr. Wallace himself. Mr. Carvalho's argument, which follows, is an instance of how, when a theory is once adopted, every conceivable fact may, by its too zealous advocates, be twisted to support it. Had these twig-like caterpillars been rejected by birds, it would have been considered a triumphant proof of the theory of Natural Selection; the fact that "they are eaten with great relish," we are told is equally "really in its favour"!

Westminster Hospital, Dec. 17 ALFRED W. BENNETT

Is Mimicry Advantageous?

THE discussion of mimicry among butterflies, in the recent numbers of this Journal, has brought to my mind some considerations which seem to have been overlooked by those who have treated the subject.

Of the fact of mimicry there can be no possible doubt, and in some instances it is even more striking than has been asserted. For instance, in North America, Messrs. Walsh and Riley have pointed out the resemblance between *Danais Archippus* and *Limenitis Misippus;* they might also have shown that in the extreme southern states where *L. Misippus* occurs, and *D. Archippus* is replaced by *D. Berenice*, the colour of the mimetic Limenitis deepens nearly or quite to the tint of the southern Danais.

But of how much actual benefit to the mimetic species is this so-called "protective" resemblance? It seems to occur where it can be of the least possible advantage to the species. The great sources of destruction here, as in all groups of animals, are in early life. How large a proportion of the eggs that are laid by butterflies ever finally produce imagines? Let those answer who have attempted to follow their history in their native haunts. My experience leads me to believe that, at the very least, nine-tenths — perhaps ninety-nine hundredths — never reach maturity. Hymenopterous and dipterous parasites beset them at every step; the eggs, although so small and often heavily ridged, cannot escape the ovipositors of the tiny Pteromali; while in attempting to breed caterpillars taken in the field, the chance is so greatly against the evolution of a butterfly, that hymenopterists actually choose this method of supplying *their* cabinets. "Of two hundred larvæ of *Pieris Brassicæ*," Mr. Drewsen, of Denmark, writes to me, "I obtained only twenty pupæ; all the rest were attacked by *Microgaster glomeratus*," and my own attempts with the larvæ of *Pyrameis Atalanta*, both in America and Europe, have been even more unavailing. These caterpillars seem to be peripatetic banquetting halls of Microgasters and Tachinæ.

* See NATURE, Vol. ii. p. 70.

Now it is a curious fact that while the globular egg of *Limenitis Misippus*, with its deeply-pitted shell, defended by long filamentous spines, is constantly attacked by parasites; and the grotesque, hump-backed, strangely-coloured caterpillar of the same species is likewise infested to an extraordinary degree, I have been unable to discover by very careful search any evidence that the egg or larva of *Danais Archippus* is ever pierced by a parasite; yet the egg is not small and only lightly ribbed, and the caterpillar large, fleshy, smooth-skinned, and gaily banded, living on the widely-separated leaves of Asclepias, with no attempt at concealment. The abundance of the imago of the Danais is then due quite as much to the immunity of the egg and larva from the attacks of parasites, as to any freedom it may itself enjoy from pursuit by insectivorous birds.

Although I have hunted butterflies for fifteen years, I confess I have never seen one in a bird's bill, and my faith in that method of lessening their numbers is very slight. Birds, too, must be their greater foes in earlier life; and the chances of living, which are certainly against them before they take wing, seem afterwards rather in their favour, at least, until they have accomplished their mission.

If, then, such an extraordinary element as Mimicry is to be summoned to the aid of Natural Selection, and can perform its task in such a masterly manner, why has it been made to waste its energies upon unimportant material? If the object of the resemblance be protection, why does not the unfortunate caterpillar of the Limenitis mimic the more favoured larva of the Danais?

I cannot now consult the writings of Messrs. Wallace and Bates, nor do I remember their statements respecting the abundance of the mimetic species compared to that of its normal congeners. In my own country *Limenitis Misippus* is, as a general rule, more common than *L. Ursula*, but the difference in their numbers is not very marked. It is by no means as great as one would expect had Mimicry in the imago state so strong a protective power as has been assumed. Two closely allied species,* occupying the same geographical area, do not often occur in the same abundance, whatever be the cause; and the disparity in numbers in these two species of Limenitis is no greater than occurs in many instances where mimicry plays no part.

Cairo, Egypt, Nov. 9 SAMUEL H. SCUDDER

Nepenthes

THE allusion to Nepenthes in Mr. Buckton's interesting article in a late number of NATURE, on the liquid secreted by this and other plants, prompts me to place on record a few facts regarding that genus, at which I have just arrived, after monographing the Pitcher-plants for the "Prodromus Systematis Vegetabilium" of De Candolle; a work of which the publication is suspended, owing to the siege of Paris.

The genus *Nepenthes* extends from Madagascar on the west to N.E. Australia, the Louisiade Archipelago, and New Caledonia on the east; embracing within these limits, thirty species, most of which have well marked characters in the pitcher, but which, with only two exceptions, present a wonderful uniformity in the structure of both flower and fruit. It has two foci of maximum development; the Malay Peninsula (including Sumatra), and Borneo, in both of which localities the species are not only more numerous, but more gigantic than in any other country. No fewer than twenty-one species inhabit these two countries, of which thirteen are common to both; but, what is very remarkable, the intervening island of Java contains but one representative of the genus, and that a totally different species from either the Bornean or the Malayan; thus confirming the fact first brought to light by the Dutch naturalists, of the close biological relationship between the two former localities, to the exclusion of Java. Only one species has a wide range, the *N. phyllamphora*, which extends from Sumatra to Borneo, Amboyna, China, &c., but is absent from the island of Java.

Proceeding from the Malayan islands westwards, we find one species in east Bengal, more allied to the Javanese than to any other; another in Ceylon, the old *N. destillatoria* of Linnæus (a name long usurped in our gardens by the Bengal plant), which presents the first departure from the typical structure of the genus, having a spreading paniculate inflorescence; a character shared by those in Madagascar and the Seychelles. Proceeding further west to the African islands, we find still further deviations from the type, which now extend to the structure of the seed and

* *L. Misippus* and *L. Ursula* can with difficulty be separated in their earlier stages, although so unlike in their perfect forms.

fruit; for whereas all the eastern species have very long appendages to the seed, which are no doubt instrumental in its dispersion, these appendages are very short in the Madagascar species, and are wholly absent in the Seychelle one; which thus presents a case analogous to that of the prevalence of wingless insects on oceanic islets. Lastly, the Seychelle Islands species further differs from all others in the structure of its ovary and capsule.

To sum up, deviation from the type of the genus commences on the western confines of the principal centre of its distribution, namely in Ceylon; and the initial deviation, that met with in the Ceylon species, is the slightest, but is propagated (so to speak) westwards, equally characterising the two African islands Pitcher-plants, which again deviate still further from the type; the maximum deviation, however occurs, not in the great sub-continental Island of Madagascar, where the endemic species has a considerable range; but in the very small oceanic Archipelago of the Seychelles, where the only native species is confined to the one mountain summit of one island of the group!

The only other fact that struck me as bearing upon this subject of distribution is, that though present in the Seychelles, the genus Nepenthes is absent from the Mascarene group (Mauritius, Bourbon, and Rodrigues). This is only one instance of the broad distinction that exists between the vegetation of these Archipelagos, and which is in some way connected with the fact that the Mascarene group is volcanic, the Seychelles group formed of granite and quartz. Coincident and perhaps co-ordinate with these phenomena of plant distribution, geographical position, and geological structure, are the facts that the flora of the Seychelle Archipelago is more Asiatic, and the florulæ of its several islets very uniform; whilst the florulæ of the islets of the Mascarene Archipelago differ wonderfully, and in their totality are more African than Indian. The flora of the Mascarene group may hence be regarded either as a very ancient outlying province of the African, or as consisting of a more modern assemblage of plants, derived at various periods from Africa, but subsequently much altered by causes operating in the several islets; or more probably its peculiarities are attributable to both causes. Long as the Mascarene and Seychelle islets have been colonised, under Dutch, French, and English rule, their floras are still very imperfectly known; so much, however, of Mascarene botany is known, as to show that its relations with those of the Seychelle group and Madagascar, and the relations of all these with India and Africa, are most complicated, and present one of the most puzzling problems in Phytogeographical Science.

Royal Gardens, Kew, Dec. 18 J. D. HOOKER

THE author of the notice which appeared in a recent Number of NATURE is probably unaware that a minute analysis of the "water" found in the pitcher of Nepenthes was made a few years since by Dr. Völcker. For full particulars I will refer your correspondent to "Annals and Magazine of Natural History," 27, 4, 128, and "Phil. Magazine," 3, xxxv., 192; but I may perhaps be allowed to give the results of the analysis. My extract is from Liebig and Kopp's "Annual Report, &c." "The liquid was generally clear and colourless, rarely yellowish, and reddened litmus. That which was collected from different plants gave respectively 0·92, 0·91, 0·87, 0·58, 0·62, and 0·27, per cent. of residue, which contained in 100 parts 38·61 per cent. of organic matter, consisting chiefly of malic acid with a little citric acid, 50·02 of chloride of potassium, 6·36 soda, 2·59 lime, 2·59 magnesia."

During the early part of the present year I was led to suspect the presence of some form of tanno-gallic acid in the tissue of the stalk, and the kindness of a chemical friend enabled me to verify my conclusions; but no quantitative analysis has, to my, knowledge, been made beyond the one I have referred to.

Hull, Dec. 1 H. POCKLINGTON

Cockroaches

THE facts mentioned by your correspondent, Mr. Arthur Nicols (in your number of Dec. 8), are notorious to all West Indians. A friend of mine was marked for life by these things on board a ship coming home from Jamaica.

As for their scent, if you crush one in England it smells evil enough; and I don't doubt Aristophanes's sharp Greek nose had found that out. I have known bread, &c., in the West Indies uneatable from being run over by the small dark Cockroach of England, *Blatta orientalis;* while the great pale species, *B. occidentalis,* is utterly unbearable. C. KINGSLEY

*EARED SEALS AND THEIR HABITS**

THIS paper, which forms the first number of the second volume of the "Bulletin of the Museum of Comparative Zoology at Harvard College in (Transatlantic) Cambridge," is one of great zoological importance, and likewise of much general interest. The Eared Seals, a group of marine Carnivora, which form a well-marked division of the Pinnipedia, distinguished by the possession of a small external ear-conch and other peculiarities, are still very imperfectly known, although of late years they have attracted the attention of several eminent naturalists. Unfortunately, however, the great variations which occur in the sexes and different ages of these animals, have not been sufficiently appreciated by those who have studied the few specimens of them preserved in European museums. The consequence has been that numerous artificial species have been manufactured upon stray skulls and imperfect skins, which have exhibited what were really only individual differences. Moreover, what is worse than this, under the prevailing mania for coining new generic names, more genera of Eared Seals have been established than the number of species which actually exist in nature. Foremost amongst these offenders, we regret to say, has been one of our own countrymen, who, in a recent article published in the "Annals of Natural History," has subdivided, on the most trivial characters, the family *Otariidæ* into four subfamilies and ten genera! We shall see how much more reasonable and consonant with nature are Mr. Allen's views on the arrangement of these animals.

Mr. Allen commences his paper by an Introduction, in which he discusses at some length the writings of preceding authors on this subject. He then proceeds to set forth his own views, distinguishing first of all the Eared Seals from the two other families of the Pinnipedia (the true seals and the walrus), and afterwards the different genera and species of *Otariidæ,* in a very neat and perspicuous manner. Mr. Allen is only able to recognise eight species of these animals, and considers two of these rather doubtful. Four of them belong to the "Hair-seals," or "Sea-lions," which have no under fur, and four to the smaller "Fur-seals," or "Sea-bears," which have a dense under coat, and furnish the seal-skin cloaks so much now in fashion with English ladies. The well-known "Sea-lion" in the Zoological Gardens belongs to the former group—being a female of the Southern Sea-lion (*Otaria jubata*).

Mr. Allen next begins to treat at great length of the North Pacific species of Eared Seals, of which he is able to give us a full and excellent account from the specimens in the Museum to which he is attached, together with those in other American collections. These North Pacific species are the Steller's Sea-lion (*Eumetopias Stelleri*), Gillespie's Hair seal (*Zalophus Gillespii*), and the Northern Fur-seal (*Callorhinus ursinus*). Of these three animals such full particulars are given that it seems scarcely possible that there can be any more confusion respecting them. But the most remarkable part of the present memoir is perhaps the account of the extraordinary habits and customs of the Northern Fur-seal, given from Captain Bryant's observations of these animals, on the Pribyloff Islands, off the Northern part of Alaska Territory. As is the case in other known species of Eared-Seals, there is an enormous discrepancy in the size and weight of the two sexes, the weight of the female being rarely more than one-fourth of that of the full-grown male.

The Fur-seals resort to the Pribyloff Islands during the summer months for the purpose of breeding, and in St. Paul's Island, where Captain Bryant made his obser-

* "On the Eared Seals (*Otariadæ*), with detailed Descriptions of the North Pacific Species." By J. A. Allen. Together with an Account of the Habits of the Northern Fur Seal (*Callorhinus ursinus*). By Charles Bryant. With Three Plates. 8vo. 108 pp. (Cambridge: University Press. 1870.)

vations, occupy at this season a belt of loose rocks along the shore, varying in width from five to forty rods. Twelve miles of shore line at least are taken up by what is called their "*breeding rookeries*" in this island, and are tenanted by not less than 1,152,000 breeding males and females, according to Captain Bryant's estimate. Each male seal stations himself in a particular spot, usually the same as he has occupied in former years, and keeps about a square rod of ground free around him to afford space for the reception of his ten or fifteen wives. By the 15th of June all the males have arrived, and have stationed themselves each in his own domain, not without constant growlings and fightings with his neighbours for what he considers the best station. The young males are not allowed to take a place in the "rookeries," but are driven by the patriarchs back into the sea, or compelled to resort to the high rocks above. After the middle of June, the females arrive; in small numbers at first, but increasing as the season advances, until the middle of July, by which time they are so crowded together that they often overlap one another. The old males who are nearest the shore seize upon the females at once, and of course fill their harems first. But the males who are higher up on the rocks select the time when their more fortunate neighbours are off guard to steal their wives, taking them up in their mouths, and carefully carrying them off to their own dominions, as a cat would her kittens. Struggles often occur between two males for the possession of the same female, and both seizing her at once, terribly lacerate her with their teeth. When his harem is full, the old male struts complacently around reviewing his domestic circle, and fiercely driving off all intruders. Two or three days after landing and taking up her abode, the female brings forth her single pup, after which she is ready to associate with the male. By the middle of August the young are all born, and the females are again pregnant. The old males having been constantly in their stations for four months *without food*, now leave the females and young to the company of the younger males, and go off-shore to feed. At the end of October the whole body of seals leave the island and journey southwards.

The greatest care is taken by the hunters never to disturb the breeding places of the seals in any way, and the only seals killed for the sake of their fur are the younger animals (principally males) that resort to the higher rocks above the rookeries to pass the night. A party of men armed with clubs surround a portion of the herd and drive them off sometimes six or seven miles across the island, to the place selected for killing and skinning them. By this plan the rookeries are less liable to be alarmed, and the seals are made to carry their own skins to the salting houses, which would otherwise be a work of much labour. At the present time the annual yield of seal-skins from the Pribyloff Islands is estimated to have reached 100,000, and the killing yearly of this number is believed in no way to check their increase, but rather to augment it.

This short sketch will serve to give an idea of Captain Bryant's account of the extraordinary habits of this animal, and of the way in which the large annual supply of the much-valued seal-skin coats of civilised life is produced. Many other details of the highest interest are added, for which we must refer our readers to the original article. Although several accounts have been already published of the habits of other species of this group, none, we believe, is so full and perfect as the present, which forms a valuable appendix to Mr. Allen's excellent essay already spoken of. In short, it may be truly said that, by this single memoir, more extensive knowledge has been gained concerning this little-known group of mammals than by the half-dozen different systems of arrangement of them which have lately emanated from the British Museum, and the publication of an indefinite number of (so-called) new genera and species founded upon stray skulls and imperfect skins. P. L. S.

SCIENTIFIC TEACHING IN ELEMENTARY SCHOOLS

THE following address, signed by Prof. Huxley, as President of the British Association, has been presented to the Vice-President of the Council by a deputation, consisting of the President of the Association, the General Secretaries, and the Treasurer; Sir Charles Lyell, Bart.; Sir John Lubbock, Bart., M.P.; Dr. Lyon Playfair, M.P.; and Mr. Francis Galton:—

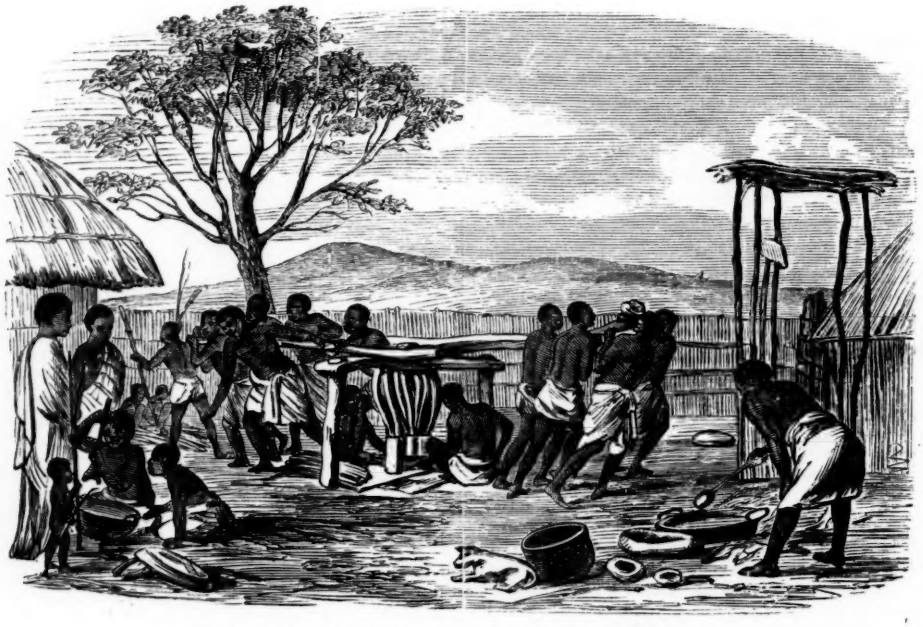
"The deputation from the Council of the British Association for the Advancement of Science waits upon you for the purpose of urging the advisability of including elementary Natural Science among the subjects for which payments are to be made under the authority of the Revised Code. We have asked you to receive us at the present time because we understand that you have announced your intention of making certain modifications in the Code. Our reasons for requesting you to give direct encouragement to the teaching of Natural Science in elementary schools are three. Firstly, we conceive such teaching to be one of the best instruments of education in the sense of intellectual discipline, and in many respects better calculated to awaken intellectual activity than other studies; secondly, we think that a knowledge of the elements of Natural Science has a high value as information; and thirdly, we are of opinion that scientific training and teaching in the elementary schools will afford the best possible preparation for that technical education of the working classes which has become indispensably necessary to the industrial progress of the country.

"We take the liberty of pointing out to you that, in asking for the introduction of scientific teaching into the elementary schools, we are not seeking for the creation of a new system or even of new executive machinery. The Science and Art Department does already provide for elementary scientific instruction; and all that is necessary to fulfil our desire is, that the system of the Science and Art Department and that of the Revised Code shall be brought into harmonious co-operation. In preferring the request that instruction in the elements of Science shall be made part of the regular course of instruction of all elementary schools, we desire carefully to guard against the supposition that we are seeking for such an amount of this kind of instruction as would interfere with the teaching of reading, writing, and arithmetic, and the other essential constituents of primary education. On the contrary, we think it very desirable that systematic instruction in elementary Science should be given only to those scholars who are able to read and write fairly; that it should be limited to certain well-defined subjects, such for example as elementary physical geography, elementary physics and chemistry, elementary botany, and, in consequence of its relation to the public health, elementary human physiology; and that care should be taken to make the instruction, so far as may be, real and practical.

"Finally, we desire to point out that such scientific instruction in the elementary schools as we pray for, would afford a means by which any child of exceptional aptitude for scientific pursuits might obtain the education suited to its capacity in the higher schools, and that in this way advantages similar to those which are offered by the scholarships and exhibitions of grammar-schools to the children of the well-to-do classes of society, would be extended to the poor and necessitous. In other countries in which well-organised systems of secondary education for the working classes exist, it has been found necessary to give a taste for Science in the elementary schools, so that the youth of the country may be induced to take advantage of the more advanced schools. While, therefore, we look with pleasure to the introduction of Science into the endowed schools of the country, we still believe that it will be necessary to link them to the elementary schools by commencing instruction in Science in the latter."

SUGAR

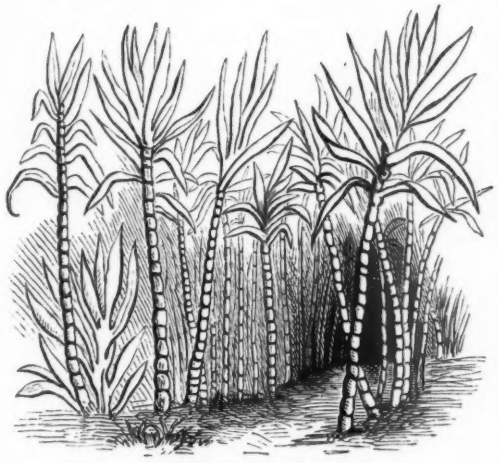
IN considering the subject of sugar, its produce, supply, uses, and adulteration, we enter upon a much wider field of inquiry than in either of our former articles, though the present has an intimate connection with our previous subjects; for neither coffee, tea, nor cocoa is usually considered properly prepared for table without the addition of sugar; it is used more or less in every part of the globe, for in the widest sense of the word, sugar is contained in most vegetable juices, indeed it is the principal food of young plants. In the rising sap of some trees in spring it is very abundant, as well as in the young stems of grasses. The starch stored up in many seeds at the time of germination is converted into sugar. The process of malting consists in forcing the seeds of the barley to germinate, and just at the time when most sugar is found, to stop their growth, so that the sugar is preserved for our use and not consumed by the growing plants. Sugar is extracted for the use of man from many distinct plants. Chemically considered, there are two kinds of sugar; one called cane sugar, which is obtained from the sugar-cane, the beet-root, the maple, &c.; the other called grape sugar, or glucose, which is chiefly found in grapes and various fruits. The bulk of the sugar used in this country is the juice of the sugar-cane (*Saccharum officinarum*, and perhaps allied species), a gigantic perennial grass, growing usually ten or twelve feet high, but in some situations attaining fifteen or sixteen feet; it has a jointed stem, somewhat similar to that of the bamboo, the upper part having a series of long, narrow leaves, and the flowers produced in large, feathery panicles. Some doubt exists as to the true native country of the sugar-cane, though it is not at all improbable that it came from Southern China and India. The plant is now very extensively cultivated in the East and West Indies, China, the Mauritius, S. America, and other parts.



SUGAR MANUFACTURE AT KATIPO, A VILLAGE IN EASTERN TROPICAL AFRICA

The use of sugar dates back to a remote age; its introduction into Europe is said to have taken place in the 9th century, when it was brought from the East into Sicily by the Saracens, and the first European plantations were established about 200 years later in Sicily and Valentia. In the early part of the 15th century its cultivation began in Madeira, the Canary Islands, Granada, &c.; and at the close of the same century Columbus introduced it into one of the West Indian Islands. Barbadoes sent large quantities of sugar into England so long ago as 1646. The sugar-cane does not ripen its seeds, and is, therefore, propagated by cuttings. The canes after planting require, according to the situation and soil in which they are grown, from ten to twelve, or even twenty months before they are ready for cutting; they are cut off near the base, and the stem is then divided into equal lengths, put up into bundles, and carried to the mill. These lengths are submitted to pressure between heavy rollers, by which the saccharine juice is squeezed out, and is collected in a cistern; it is next filtered and clarified, and the feculent matters separated by lime, a rapid system of boiling now throws off the watery particles by evaporation; and the sugar is brought to such a thickness or consistency that after boiling in one pan, its bulk is so reduced that it is removed to a smaller or medium sized pan, where it is boiled again and skimmed until it is reduced to sufficient bulk and thickness to enable it to undergo a similar operation in the next, or smallest size pan, where it is again boiled till it has assumed the consistency of a thick syrup, which partially granulates upon cooling. It is, however, still in the form of a soft mass, the crystallised portion being imbedded in a thick juice, which is known as molasses. To remove this the whole mass is put into loosely made casks or hogsheads, through which the molasses drains, leaving the crystallised portion more or less dry. After

being kept a few weeks, during which time molasses continues to drain from it, it is packed in bags or hogsheads, and is ready for shipment. In this state it is known as raw, brown, or Muscovado sugar. The process of extracting and preparing the juice for export is not exactly similar in all countries; though the principle is the same, the practice varies according to the amount of intelligence brought to bear upon it.



FIELD OF SUGAR CANE

The drawing on the opposite page, which has been copied by permission of Mr. T. Baines from one of his paintings in the Kew Museum, represents the whole process of sugar making at a village in Eastern Tropical Africa. Under the tree, in the left-hand corner, is a native cutting the cane into lengths, and others collecting them into bundles which are afterwards passed between the rollers of the press, as seen in the centre of the picture. Boiling and crystallisation are shown in the right and left hand corners respectively.

SUGAR CRYSTALS MAGNIFIED

The quantity of saccharine matter contained in the cane varies according to the nature of the soil, climate, or other conditions under which the plants are grown. An acre of land under sugar cultivation may yield from one up to four tons of sugar, and from each ton of sugar after the first process of crystallisation somewhere about seventy gallons of molasses will drain; so that when we consider the labour required to keep a sugar plantation in full working order, such as tending the plants, expressing the juice, evaporation, crystallisation, and the subsequent waste both of sugar and molasses, as well in the draining on the voyage home, as during the time of its storage in the docks, and above all, the duty demanded upon sugar by the British Government, it does seem rather surprising that the article can be retailed at the price it is, though many are apt to call out that it is not so cheap as it ought to be. Sugar in its most common use cannot now be considered a luxury; to rich and poor alike it has become a necessity, indeed, amongst the lower classes a larger proportion is consumed than amongst the middle and upper section of the community, the average annual consumption per head of the whole population of the United Kingdom being about forty pounds. The East and West Indies, Mauritius, and Brazil now supply the bulk of the sugar brought into the English Market. It is imported in hogsheads and bags, the latter vary much in size and the sugar is also of various qualities, some of it indeed as it arrives has much the appearance of black muddy gravel or sand; most of this undergoes a further process of purification and recrystallisation in our own sugar refineries, which abound at the East end of London, as well as at Greenock, Glasgow, Liverpool, and Manchester. From these refineries the sugar comes out in the forms known in trade as lump or loaf sugar, crushed lump, pieces, and bastards.

The quantity of unrefined sugar entered for home consumption during the year 1869 was 11,188,081 cwts., and this exclusive of 1,025,929 cwts. of refined sugar and sugar candy, and 741,771 cwts. of molasses. The sugars best known in the British grocery trade are Demerara, Berbice, Barbadoes, Porto Rico, and Mauritius. These are sufficiently refined and crystallised in the colonies producing them as to suit the requirements of the retail trade. Those from Antigua, Cuba, Madras, Penang, &c., usually find their way into the hands of the refiners, brewers, and confectioners. Molasses is, as we have before said, the drainings from raw cane sugar. It is used for many purposes; large quantities of rum are distilled from it, often on the plantation where the sugar is produced; and where it is not so used it is exported, the sugar refiners in England buy it up largely, and produce a quantity of crystallised sugar from it. Rum, however, is usually made from the skimmings taken from the last boiling of sugar, which are mixed with proportionate quantities of molasses and water. Though molasses and treacle are often spoken of as identical, they appear to be different in their origin, for while the former is the drainings of raw sugar, the latter is the drainings of refined sugar. We have hitherto spoken only of cane sugar, or, to speak more correctly, of that obtained from the sugar-cane, but a large portion, indeed the bulk, of the sugar used on the Continent, is obtained from the beet-root (*Beta vulgaris*), the manufacture of which forms a separate article of industry.

JOHN R. JACKSON

NOTES

INTELLIGENCE has been received of an accident which occurred to H.M.S. *Psyche*, carrying the Sicilian section of the Eclipse Expedition from Naples to Catania; but, we are happy to announce, without injury to any of the passengers or crew, or loss of any of the instruments. The following are all the telegrams to hand at the moment of going to press:—"The *Psyche*, with the Eclipse Expedition on board, has struck on a sunken rock near Catania. All hands have been saved, and also the scientific instruments. The captain, who has behaved most nobly, is still on board, and, with a view to save the ship, has telegraphed to Malta for assistance." The following telegram has been received at the Admiralty:—"*Pysche* has struck, while running by chart, on a sunken rock near Catania. All saved. Instruments sent into Catania. Commander Fellowes has acted nobly, and hopes to save ship, if assistance comes at once from Malta, where he has telegraphed. *Royal Oak* sent for." We may congratulate ourselves that the

expedition was in the hands of trained men belonging to one of Her Majesty's ships. We learn that nothing has occurred which need in the least imperil its success, and t ust that even the ladies of the party will have suffered nothing worse than temporary inconvenience and alarm.

MR. J. R. HIND, writing to the *Times*, states that, although the Eclipse of the Sun, which takes place to-day, will have been exceeded in magnitude by more than one of the eclipses which have been visible in this country during the last thirty years, it will yet be the greatest eclipse that can be witnessed in England during the remaining thirty years of the present century, and on this account possesses a degree of interest which does not always attach to partial eclipses. If we take successive intervals of thirty years, commencing with 1781, and note only those eclipses visible in London, in which the moon has covered more than half the sun's diameter, we find between 1781 and 1810 two eclipses, between 1811 and 1840 six eclipses, between 1841 and 1870 seven eclipses, while between 1871 and 1900 there will be one eclipse only of similar magnitude. This single eclipse in the ensuing interval of thirty years will not occur until the last year of the century, or till the 28th of May, 1900, and the magnitude will not then quite reach 0·7 of the sun's diameter. The next solar eclipse visible in England is a small one on the morning of May 26, 1873.

THE French Eclipse Expedition may not have proved a failure, as has been feared. We have received intelligence from Paris that on the 1st December M. Janssen left in a balloon, assisted by a sailor. No letter was given him in order to prevent the Prussians detaining him as a prisoner of war. A balloon reached Brittany about that time, and was styled a private balloon. Telegrams and notices were sent to France from Mr. Lockyer, to invite M. Janssen to join the English Eclipse Expedition, but it appears that none of these communications have reached him, owing to the interruption of regular postal telegraphic service in France. M. Janssen was intending to proceed to Medeah, an Algerine town.

SOME time ago we announced that Sir Roderick Murchison had offered the munificent sum of 6,000*l.* for the endowment of a Chair of Geology and Mineralogy in the University of Edinburgh, on the understanding that the annual proceeds of this sum would be supplemented by a grant from Parliament. We are happy to state that Government has consented to this proposal, and has agreed to recommend an annual grant of 200*l.* This desirable result (for which the University, we believe, is largely indebted to the earnest co operation of its member, Dr. Lyon Playfair) will be welcomed as another evidence that our authorities are not so indifferent as they have been supposed to be to the claims of scientific education.

DR. HUREAU DE VILLENEUVE, secretary to the French Aëronautical Society, and editor to the *Aeronaut*, a paper devoted specially to aëronautics, has established at his residence an ambulance for aëronauts. He had to attend to a few cases from accidents of different descriptions in the management of captive balloons, and fewer of soldiers who had drawn the ropes for their aërial observations. M. de Villeneuve is to open a regular course of lectures on aëronautics at the Petite Sorbonne. It is the third time that a regular course of lectures has been delivered in Paris on this subject: the first time by Dupuis Delcourt, at the Athénée about forty-five years ago, when Comte was delivering his lectures on Positive Philosophy; the second time by M. W. de Fonvielle, at the Lecture Hall of the Boulevard de Capucines, three years ago.

THE new Meteorological Observatory established by the city of Paris in the well-known Palais du Bey de Tunis, which was a part of the great Champ de Mars Exhibition, is no longer in operation. It was put into requisition to be used as a barracks. M. Sainte-Clair Deville, the elder, who was the director, has protested against such a requisition, but his protest was wholly disregarded.

M. MARIE DAVY is now in Paris, and engaged in meteorological observations, as well as M. Chapelas Coulvier Gravier, who keeps his watch from the Luxemburg Palace for falling stars. He publishes regularly the records of the observations in the *Comptes Rendus* and the *Journal Officiel*. He has published a description of several magnificent auroral displays, which were described by several witnesses in different papers.

A VERY influentially-signed memorial from heads of houses, professors, tutors, lecturers, and fellows of colleges in the University of Cambridge, has just been sent to the Lord President of the Committee of Privy Council on Education. The memorial prays that women may be appointed to the office of Inspector of Schools, and points out some of their qualifications for that responsible office. The memorial is signed by seventy-two resident graduates, all of whom are fellows of colleges or hold college or university offices in the University of Cambridge. Among those who sign are the Vice-chancellor and five other heads of houses, including the Masters of Trinity and St. John's; nine university professors; the senior tutors of every college, with three exceptions; all the tutors, assistant tutors, and lecturers of Trinity College, with two exceptions; and of the remainder all except eight are engaged officially in teaching in the Colleges or University.

THE death is announced, in his seventy-first year, of the Rev. Joseph Bancroft Reade, President of the Royal Microscopical Society. He was educated at Caius College, Cambridge, where he took his B.A. degree in 1825, when he was thirty-sixth senior optime in the mathematical tripos. In 1839 he was presented by the Royal Astronomical Society to the vicarage of Stone, near Aylesbury, and at the time of his death was rector of Bishopsbourne, near Canterbury.

WE shall be much obliged to any of our correspondents who will oblige us (for the purpose of drawing up a tabular account) with particulars of any hitherto unrecorded meteorological phenomena which may have occurred during the present year, as auroras, earthquakes, large sun-spots, meteors, storms, volcanic eruptions, haloes, &c. Similar information will be very acceptable from the continent of Europe, America, or the Southern Hemisphere.

THE Royal Horticultural Society has been compelled, by the pressure on its funds, to dispose of a portion of its gardens at Chiswick, the most valuable portion of its property in a scientific point of view. Among the articles sold were a number of fine trees, Pyramid Pears, Dwarf and Trained Apples, Filberts, Wellingtonias, Cupressus, Piceas, Araucarias, &c., in all no less than 12,757 plants, fetching about 600*l.* The portion of the Gardens which still remains covers about 33 acres; and the orchard will be reorganised on a smaller scale, and the trials and experiments, practical and scientific, will still be carried on. The Gardens were originally founded in 1821.

THE galleries of the Royal Albert Hall, which are to be used for the display of architectural drawings and models in the forthcoming International Exhibition of 1871, are approaching completion. Architects have been invited to inspect the Hall, and to see the galleries appropriated to their works, on Wednesday, December 21, at 11.30 A.M. Some trials of the acoustic properties of the building were to be made between 12 and 12.30.

THE *Journal of the Society of Arts* states that the Council of the Society has sanctioned a plan for establishing a National Training School of Music. For promoting this purpose it is proposed that a musical section of the society be instituted, with a separate

fund, in order to give concerts annually in the Royal Albert Hall; these concerts to consist of vocal and instrumental music of the highest character. After paying the expenses of the concerts, the profits are to be applied to the establishment of a National Training School for Music.

THE Perthshire Society of Natural Science proposes starting a Quarterly Magazine, to be called the *Scottish Naturalist, and Journal of the Perthshire Society of Natural History*. It will be specially devoted to recording observations and discoveries made in the northern part of this island; and it is intended that it shall contain (in addition to the "Proceedings" of the Society), reports of the meetings of Scottish Natural History Societies; a record of Scottish captures; observations and discoveries both zoological and botanical; scientific jottings; notes and queries; lists of species for distribution in exchange, &c. As the carrying out of this scheme depends entirely upon the encouragement and support received by the Society, it is hoped that those interested will at once send in their names as subscribers to the honorary secretary, Mr. A. T. Scott, Clydesdale Bank, Perth.

THE *Saturday Review* of December 10 refers to "the gigantic Lycoperdon, or Puff-ball, which in one night acquires the bulk *of a child of ten years old*, and produces about 96,000,000 cells a minute!" We have both seen and heard of Puff-balls as large as a child's *head*, but one of this "bulk" is, we imagine, somewhat rare.

THE Folkestone Natural History Society has issued the following programme of its proceedings for the present (its third) winter session:—Nov. 8: Public lecture on "Solar Eclipses," Rev. C. L. Acland, M.A. Nov. 23: Microscopical Conversazione. Dec. 13: Public lecture on "Food, and the Process of Digestion," F. Fagge, Esq., F.L.S. Jan. 10: Public lecture on "Fossils and their Teachings," Henry Ullyett, hon. sec. Feb. 1: Annual meeting. Feb. 7: Public lecture on "The Natural History of Language," by W. J. Jeaffreson, Esq., M.A. Feb. 22: Ordinary meeting, paper, and discussion. March 7: Public lecture on "Iceland and Spitzbergen," by C. E. Fitzgerald, Esq., M.D., president. March 22: Ordinary meeting, paper on antiquities, and discussion. March 28: Public lecture on "The Materials for Antiquarian Research in S. E. Kent," by the Rev. Canon Jenkins. A class in Botany is held every Wednesday, at 4 P.M., by the Rev. C. L. Acland, and one in Geology every Monday at 8 P.M., by Mr. Ullyett. The Museum is open free on Thursday evenings and Saturday afternoons, as well as on the occasion of meetings; and a library of reference is in course of formation.

MR. EDWIN C. REED has been employed by the Director of the Museum of Santiago, in Chili, to arrange the insects. He has classified the foreign insects, which had hitherto remained unpacked. Mr. Reed is preparing a Chilian collection to send to California in exchange for a collection from that country.

THE United States Government commenced on the 1st of November the publication of a daily record of the state of the weather in various parts of the country. The following extract from the *New York Journal of Commerce*, dated Nov. 5th, shows the view entertained in the States on this subject:—"The Federal Government has lately done one thing which men of all parties will agree in commending heartily. It has made arrangements to furnish daily reports of the markings of the barometer and thermometer, the direction, velocity, pressure, and force of the wind, and the state of the weather, at points in different parts of the country. The shipowner, master, or merchant, reading this journal, has before him every day trustworthy advices of the weather all over the United States only a few hours old, and sufficiently fresh to apprise him of the danger or safety of sailing or making shipments from this port. Much depends on the accuracy of the reports, and for that we find good assurance in the fact that they are prepared by army officers, most of whom have received an education scientific and practical enough to qualify them for the work. The Associated Press have made an appropriation to have an observer among the party who will watch through the winter on the top of Mount Washington, White Mountains. From that point also we expect to receive daily bulletins, which will not only be serviceable to commerce, but in our coldest weather here may make people more comfortable to think how much colder it is away up on that windy peak. Prof. Hitchcock will be in charge of the party, which comprises a number of able scientists. The Chamber of Commerce is making a move to supplement the action of the Government at this point with a little more money." The places at present contributing "weather reports" are Augusta (Ga.), Boston, Buffalo, Cleveland, Cincinnati, Chicago, Cheyenne, Detroit, Duluth, Lake City (Fl.), Milwaukie, Montgomery, Mobile, Nashville, New Orleans, New York, Oswego, Omaha, Rochester, St. Paul, St. Louis, Toledo, and Washington.

A ST. PATRICK, says the *Pall Mall Gazette*, is evidently wanted in India as much as ever he was in Ireland. During the year 1869 no fewer than 11,416 persons in the Bengal Presidency died from the effects of snake bite. The return giving us this information has been carefully compiled; all the merely sick and wounded have been omitted, as well as those sudden deaths which in India are often attributed to snake-bites by heirs to property unduly eager for their inheritance. Such a mortality from such a cause is sufficiently startling to the sophisticated mind of a stay-at-home Englishman, but the more surprising fact remains that this destruction of human life goes on year by year, and that no efficacious means are adopted to check its ravages.

The *Pall Mall Gazette* states that we owe our supplies of Indian cotton to the American war, and we may have to refer the cultivation of tobacco in our colonies to the present campaign. A good deal of the leaf employed in the manufacture of cut tobacco comes to us from the Continent, and of course that source is now closed; but the smoker may be consoled by hearing that India, Jamaica, and Natal are all engaged in cultivating the plant. Latakia from the West Indies has been received in London and reported upon favourably, and the samples of tobacco from Natal are said to be remarkably good. What the Indian Government has already done for the cultivation of tea, cinchona, and ipecacuanha, it is now doing for the tobacco plant. Seeds of the best varieties have been distributed in suitable districts, and the time may speedily come when the Bengal cheroot may be a production of the Presidency.

FROM the report of the cotton department of India it seems that the crops in the several districts have, during the past year, yielded a satisfactory return. We also learn that a very extensive system of adulteration exists by mixing two or more qualities in one bale, to which a stamp, indicating a superior quality, is affixed. With regard to the use of English ploughs which have been introduced, it is said that "the cohesion and tenacity of the richer black cotton soils are evidenced by the manner in which they get rent and cracked into deep fissures instead of becoming pulverised by the rapid contraction they undergo when exposed to the fierce rays of the sun after the crops have been removed, and from the same cause the upper surface becomes baked and hardened into a crust, which is about as inaccessible to the plough as if it were a pavement. The cultivator has accordingly to wait until the advent of the monsoon has softened and removed this crusty impediment, and, if it should happen that the first crusts are very heavy and continuous, he is still further delayed from an opposite cause, namely, on account of his fields having become too soft for his cattle to move on, so that he has to wait for a favourable break to get rid of the surface moisture." In this state of the land the plough gets clogged,

and the animals have not strength to move the instrument, so that "both ploughs and ploughmen succumb, and the antediluvian implement of the ryot is found to be the only feasible one."

SOME idea of the damage done to vegetation by locusts in tropical countries may be gathered from the following account of a raid made by them in an East Indian cotton plantation. The means adopted to repel them was by recourse to the discordant sounds of native music—horns, tom-toms, and pipes—aided by the waving of flags and branches of trees. These measures, undoubtedly, saved the produce; for, judging by the performance of the very small number that succeeded in gaining admission to one of the finest fields unobserved, had a full complement effected a lodgment, one hour would have sufficed to strip every tree of its leaves, though the foliage was abundant, and the plants in one field from five to six feet high. The immunity which the native Indian cotton enjoyed from the attacks was considerable, considering the avidity with which they devoured the exotic descriptions, and, true to their early traditions, the Egyptian was evidently an especial favourite. Some of the swarms that passed over the country at that time were exceedingly numerous. The arrival and settlement of one mighty mass was a remarkable sight. What was first observed was a sort of haze on the verge of the horizon, in a long line, as if a steamer had passed, and its smoke was rising into vapour; this was some hours before the insects arrived. The cloud gradually thickened, and rose higher as they approached. When they got fairly overhead the air became darkened as if night was setting in, it being yet mid-day, and the peculiar sound which accompanied their flight resembled that of the rustling of the leaves of the peepul tree when agitated by light winds; but it is not until they have settled down that any idea can be formed of the immensity of their numbers, and the early dawn, before sunrise has warmed them into life and motion, is the time to witness this most extraordinary sight. In the instance now referred to the appearance the face of the country wore would be best described by supposing that a tolerably heavy fall of snow had taken place, only that the colour of it was a light brown, and this extended for miles, as far, indeed, as the eye could reach. Trees were favourite perching-ground for the night, and the manner in which they contrived to crowd upon them, piles over piles, concealing every vestige of leaf and branch, gave the trees a singular appearance. At one spot a stout and wide-spreading branch of a banyan tree had snapped at its stem from the incumbent weight of the insects.

RICH mines of gold and silver are being daily discovered in the State of Tulima, in Columbia, according to late advices.

A RECENT number of the American *Journal of Chemistry* contained the following story of the first introduction of the stereoscope to the *savants* of France. The Abbé Moigno took the instrument to Arago, and tried to interest him in it; but Arago unluckily had a defect of vision which made him see double, so that on looking into the stereoscope he saw only a medley of four pictures. The Abbé then went to Savart, but he was quite as incapable of appreciating the thing, for he had but one eye. Becquerel was next visited, but he was nearly blind, and consequently cared little for the new optical toy. The Abbé, not discouraged, called next upon Puillet, of the Conservatoire des Arts et Métiers. He was a good deal interested in the description of the apparatus, but unfortunately he squinted, and therefore could see nothing in it but a blurred mixture of images. Lastly, Biot was tried, but Biot was an earnest advocate of the corpuscular theory of light, and until he could be assured that the new contrivance did not contradict that theory, he *would* not see anything in it. Under the circumstances, the wonder is that the stereoscope ever got fairly into France.

MIMICRY AND HYBRIDISATION *

SOME time since I had occasion to study with care, for the purposes of a work on which I am engaged, the phenomena of mimetic analogy made known by Mr. Bates, which have lately formed the subject of discussion at the British Association, and in the pages of NATURE, in which I observe with pleasure that one of our body, Mr. A. W. Bennett, has borne an honourable part. Neither he nor any of the gentlemen who have written on the subject, have, however, so far as has come under my notice, brought the point to its real issue. They have accepted battle on the field on which Mr. Bates has placed it, and although they may have achieved a victory over him, they have not succeeded in rescuing the subject from its obscurity. He may be wrong without their being right. I am not surprised at their having been led to accept his premises; when I first approached the subject I did the same; but the longer I live and the more extended my experience becomes, the more surely do I find that when a theory looks shaky and unsound, the place to look for the flaw is not in the upper story, but in the basement. It is in the foundation that the crack will almost invariably be found. I am sure it is so here.

Mr. Bates found in the Valley of the Amazons a number of species of a Northern tribe of butterflies, wearing the colour and form of a Brazilian tribe, and so like in their varieties and strains that they obviously represent some different phenomenon from the ordinary one of mere difference in species. To account for this he devises a theory on the Natural Selection plan. The Brazilian tribe has a bad smell, and birds and insects of prey consequently do not feed upon them, and the Northern tribe, in the course of their variation in the dark, accidentally produce one something like the Brazilian one, which produces others in the same direction by Natural Selection, until the mimics are brought to perfection. Every inch of the ground he goes over here is mined and unsound—the bad smell has not been observed in North America where similar mimicry occurs—birds and insects of prey hunt by sight and not by smell, and the various communications on the subject in NATURE point out a variety of other insuperable objections. But my object is not so much to show that a friend and entomological brother has been seduced by a "bad smell" to go on a wrong scent, like a good dog after a red herring, but to find out the true explanation of the phenomenon.

The explanation seems to me to be simply Hybridisation; but before committing myself to it, as there were one or two points on which I was not sure how far the phenomena corresponded with those of hybridisation in plants, I applied to my friend Mr. Isaac Anderson Henry for information upon them, and he has sent me a paper (for the Scientific Committee of the Horticultural Society), as well as some other information, which enables me now to say that there is not a phase or a fact in the mimicry in question, for which I cannot produce the exact counterpart in the hybridisation of plants.

In the first place the mimicked and the mimickers are always found together, and even the mimickers of varieties are only found beside the varieties that they mimic. Now, it is plain that if the resemblances be due to hybridisation, it is inevitable that the two must always be found together, at least in the first instance. It may be that after the hybrids are established and advanced into the position of actual species, the species (*i.e.* the parent and offspring) might diverge from their primary locality, the one to the right and the other to the left, and so cease to be found together; but this must be an after act, and consequently an exception. The natural condition is to find both together, and so they are always found together. But this would not be the natural condition if the mimicry were produced by Natural Selection. The same enemies are found over thousand of miles, and the same kind of enemies over tens of thousands; and there is no advantage to be gained by mimicking one variety of Danais more than another. The same advantageous results would be obtained by mimicking in the east the form that prevails in the west, or in the north the form that prevails in the south, but the imitation of each variety is limited to the district which it inhabits, however narrow and restricted it may be. Natural Selection, therefore, fails entirely to account for the localisation of the mimickers of varieties.

In the next place the mimicked occur always in overwhelmingly greater numbers than the mimickers. Mr. Bates says:—"The Ithomiæ (Danaids) are all excessively numerous in

* This paper was originally presented to the Scientific Committee of the Horticultural Society (Dec. 7, 1870), but has not yet been published elsewhere.

individuals, swarms of each kind being found in the localities they inhabit. The Leptalidæ (mimics) are exceedingly rare; they cannot be more than 1 in 1,000 with regard to the Ithomiæ." This is quite what we should expect if the resemblance is due to hybridisation. Hybridisation is not the normal mode of producing either species or individuals. It is not the plan laid down by Nature. Being exceptional, it is, of course, comparatively rare. But there is no reason for rarity if it be the result of Natural Selection. That operation is going on equally upon all, and under that hypothesis mimicry is just as powerful an influence in modifying and producing forms as any other; and there is no reason whatever why it should have less conspicuous results; indeed, it should have more, if we judge by the long-continued persistence of influence which must have been in operation to produce such exact resemblances, and which, indeed, seems very much thrown away when confined to the 1 in a 1,000 mentioned by Mr. Bates.

Although mimicry occurs between various tribes or genera, it has been observed most frequently in connection with the most common species of the country. This is what would naturally be the case with hybridisation, supposing all to start fair and to be equally liable to hybridisation. But this is an assumption which we are scarcely warranted in making, and I therefore do not press this inference further than as of some conditional value.

After the second generation of hybrids in plants, it was first shown by M. Naudin, and is now well known to all hybridisers, that those which do not revert to type break out into an overflow of irregular variation, which supplies many of his most remarkable sports to the horticulturist, and many of his most puzzling difficulties to the systematic botanist. On the assumption that the mimicry in question is the result of hybridisation, we should therefore expect to find a marked degree of variation among the mimicking species. And so we do. Mr. Bates figures no less than fifteen varieties of *Leptalis Ithomiæ*, one of his mimics, which itself mimics seven different species (all very close to each other, however, and perhaps scarcely deserving the name of independent instances.) Mr. Trimen figures six varieties of *Papilio Merope*, which supplies four of his instances of mimicry, and Mr. Wallace's imitating Papilios were in like manner remarkable for their variations. It seems a fair inference that when the mimicking species are not variable they have been established before the second generation of hybrids, and where they are variable they have been established subsequent to the second generation, and have experienced the usual shock to stability occasioned by such repeated loosening of the fetters of specific identity.

Mr. Bates's list of mimics and mimicked species shows, too, that when a species is mimicked by one species or genus it is often mimicked by more, a fact which, applied to the idea of hybridisation, simply means that that species had a readiness to take to itself wives of more than one of the nations round about. Out of twenty-eight Danaoid species cited by him, which had been mimicked or had families from strange husbands, fourteen had families from one each, three from two each, and six from three each. It is only what we find in plants, that some are more open to hybridisation than others; or perhaps, analogous to our moral experience, that where scope is allowed to our own passions, license soon degenerates into libertinism.

Another feature, familiar to all hybridisers, occurs in these mimicries. Notwithstanding the statement of Wichura to the contrary, it is now perfectly well known that in attempting to obtain a cross between two species we often fail when we work with the male of one species and the female of the other, while we succeed when we reverse the process and take the male of the latter and the female of the former. In plants the cases where this capability of crossing in only one direction occurs are beyond number. Mr. Isaac Anderson Henry cites many of them in his late Presidential Address to the Botanical Society of Edinburgh, and in the paper which I have now the pleasure to lay before the Committee. The very same thing has occurred with the mimicries recorded by Mr. Bates. They are all on one side of the house. According to my view (indeed if hybridisation is once allowed to have been the motive power, it must be according to every one's view), the parents were the Danaids on the one side, and the cabbage whites (Pieridæ) on the other, for all the mimicked are Danaids with their special characters, viz., only four apparent legs, while all the mimickers, like the whites, have their special characters, six legs apparent. If they had been hybridised from both sides, we should have had some Danaids with the form and colour of the whites, as well as whites with the form and colour of Danaids; but we have not. The case which so often occurs in plants has obviously occurred here. The cross was taken only from one side. Which is it? I apprehend, from other examples, that it should be on the side of highest organisation—that is, that the male parent has been of the lower organisation, and the female parent (the actual bringer forth) of the higher. Now, which is the side of highest organisation in the Danaids and Pieridæ? Is it that of greatest strength? If it were so, it would then be the Danaids, for they are larger, finer, and more powerful than the more northern whites. But organisation is a higher test than mere strength. This, too, seems to be on the side of the Brazilian tribe. Mr. Bates so considers it, and his reason is that, the essential quality of butterflies being flight, the type which has most attention paid to its wings and least to its legs, must be highest of its order. Others think differently, and say that a type which has had two of its limbs (its anterior legs) almost atrophied, cannot be so perfect an animal as one which has them all in perfection. But I agree with Mr. Bates on this point (at all events in his conclusion). The greater number of legs cannot be any indication of higher organisation, or a centipede might dispute supremacy with ourselves, and push us from our stools. Multiplicity of sub-division or repetition of parts is acknowledged by all physiologists to be an indicatior on inferiority of organisation. The fewer limbs, that is the simpler the apparatus that a creature can do its work with, the higher the perfection of the machine. Therefore, doubtless, Brazilian Danaids are the higher type, and if (as I believe to be the case), in crosses of difficult accomplishment, the female is the higher parent, then the cross from which these mimics resulted was one by the males of the whites upon the females of the Danaids.

In what I have above said as to one-sided crossing, I have assumed that in plant-hybridisation the fact would be admitted; but as it is in contradiction to the statement of so eminent an authority as Wichura, I shall remove all doubt from the subject by quoting Mr. Anderson Henry. He says:—"I regret to differ from so great an authority as Wichura (who has maintained that 'the products which arise from reciprocal crossing in plants, unlike those which are formed among animals, are perfectly alike'), and must venture to demur to the doctrine in more decided terms than Mr. Berkeley does. I have had so many instances of hybrids taking sometimes to one side and sometimes to another, *but most frequently to that of the mother*, that to those who, like me, have tried their hand with many genera, it would be a matter of supererogation to give instances. I have had them by the score."

But the mixed product also corresponds with another fact observed in hybridisation. Mr. Henry informs me that in some of his crossings of plants he has only succeeded in altering the flowers, the foliage continuing persistently the same as that of one of the parents. He has not succeeded in distributing the union through all parts. That is exactly parallel to what we see in these mimicries. The number of legs and the nervation of the wings (in other words the more structural portions of the animal) remain special as in one parent, while the colour and form of the wings, &c., is taken from the other. In the butterflies it is the more structural parts (legs, nervures of wings, &c.) of the male parent which are observed in the offspring, while the form and general appearance only of the female parent is adopted. In plants it may be a question whether we should consider the flower or the foliage as the more structural parts—for my part I should take the flower as the more important, and therefore equivalent to the structure of the legs and wings; and the foliage and habit of the plant in Mr. Anderson Henry's case as equivalent to the colour and form of the wings and general appearance of the insect. Another phase of the mimicry, which I have no doubt will be found to have also its parallel in the hybridisation of plants, although I am not able to cite any instances exactly in point, is that in species which have dissimilar sexes, it sometimes extends to both sexes, the males being like the males and the females like the females, but in other instances is confined to the females. I believe that the reason why I have no case in point to cite in plants is that it can only be had in dicœcious plants, and the hybridisation of dicœcious plants has hitherto been scarcely at all attended to. Mr. Henry has some coming forward, but they have not yet flowered.

The last point to be noticed is one of some importance, as being the only one furnishing a shadow of objection to the explanation of the mimicries in question by hybridisation. It is that

the nearest natural allies of both the mimickers and mimicked are *not* always to be found in the same district. This deserves the more attention, since it appeared so strong to Mr. Bates as to lead him to relinquish the idea of hybridisation as an explanation after it had crossed his mind. "The explanation," says he, "that the whole are the result of hybridisation from a few originally distinct species cannot at all apply in this case, because the distinct forms, whose intercrossing would be required to produce the hybrids, are confined to districts situated many hundred miles apart."

Before I proceed to show how simple the explanation of the absence of one of the parents is, I must beg to note in passing the admission that there are distinct forms whose intercrossing would produce the hybrids. That granted, I would remind the reader of what Mr. Bates has obviously overlooked, that we are dealing with a phenomenon probably of a very ancient date, and that one side of the parental stock may have disappeared in the course of time. I have elsewhere suggested, in regard to hybridisation as a possible originator of species, that it must be a necessary accession to such an event that the hybrids should have opportunity of isolation, such as might be obtained by thinly peopled districts where they might settle, spread, and establish themselves. Now, certainly, the Valley of the Amazons, the Malayan Archipelago, and many parts of the South of Africa (lands whence these mimetic analogies come) have at different periods all been at one time unoccupied land; for all of them have been raised from the bottom of the sea, and been peopled by the influx of the inhabitants of neighbouring lands. No one knows better than Mr. Bates that at one time Brazil was unconnected with New Granada or the Andes. The Danaids were then inhabitants of it, but not inhabitants of the countries about it; while the Pieridæ, or cabbage whites, were what I have elsewhere denominated a microtypal tribe from more temperate climes, and were present in the Andes and the mountain countries, as Columbia, connected with them. In the natural course of things, therefore, when the Valley of the Amazons was changed from the bottom of a sea to dry land, the Danaids would spread into it from Brazil, and the Pieridæ from the north and west, and meeting in an open, as yet, unpeopled country, hybridisation might take place under one of the few circumstances where I have thought it possible that it could retain its place and establish its products as species. The objection that frightened off Mr. Bates is, in reality, no objection at all to the hypothesis of the mimicry being due to hybridisation, that we are not always, or even that we should not at all be able to identify the probable parents of the mimickers as inhabitants of the same country as their supposed descendants. One of the parents we know to be present (the so-called mimicked), but there are excellent reasons why the other parent should not be present. It is of a northern type, suited for our temperate regions, but not adapted to the tropics except at a higher elevation and a cooler temperature than the damp, hot valley of the Amazons. Although, therefore, it might descend into that region, it is not only a natural but almost a necessary inference that it would not find it congenial or habitable, and although it might live long enough in it to found a dynasty of mimickers, it would soon die off from unsuitable conditions, while its hybrid offspring bred from the tropical Danaids might, from the black blood so imparted to them, find it sufficiently well suited for them.

There is yet another phenomenon connected with Mimicry, which possibly may also be connected with hybridisation, viz., the occurrence of what Mr. Wallace has called dimorphism in insects among the mimicking or mimicked species. We must not, however, confound this dimorphism with Darwin's dimorphism in plants. The two are totally different things, and, as it seems to me, have no relation or analogy to each other. In plants the dimorphism is always confined to the reproductive organs, in insects it has apparently nothing to do with them. Moreover, it seems to me that all the instances of so-called dimorphism in insects that have yet been recorded, are nothing but examples of variation, perhaps complicated by hybridisation. M. Reinhard, of Bautzen, has shown that this is the case with regard to Mr. Walsh's conclusions respecting the dimorphism of certain gall-flies, for he had found that the galls of various species appear to be so transitional between other forms, that they can only be known with certainty when the perfect insect appears. It appears to me to be also the case in all those instances where the dimorphism is confined to particular districts, as in the *Papilio Turnus* of North America, where all the females are yellow in the New England States and in New York, while in Illinois, and farther south, they are all black, and in the intermediate region, both black and yellow females occur in varying proportions. And the case is not open to any doubt, because in the intermediate district, both yellow and black insects have been bred from the same batch of eggs. Now, if the case had been that *both males and females* equally varied, and that in the south all were black and in the north all yellow, with intermediate gradations in the districts between, we scarcely suppose that any one would have thought of calling it a case of dimorphism. If they did, then all climatal variations (and their name is legion) would come under the same category. It is only dimorphism, because the change is limited to the female. But is this a good ground? Physiologists are unanimous in holding that neither the male nor the female is the species, but both; and if that be the case, in what does a variation in the female and not in the male differ from a variation in both but in degree? Most of Mr. Wallace's instances of dimorphism are of this character—the male being the same in a number of islands in each of which the female differs. All these I regard as mere instances of climatal variation, in which the variation shows itself only in that part of the species called the female. An occasional case of variation from some other cause, as from hybridism, may possibly come to complicate this phenomenon; but it appears to me to be sufficiently explained by variation, and the circumstance above mentioned is significant that where mimicry occurs in species having dissimilar sexes, it too is often confined to the female.

A. MURRAY

SCIENTIFIC SERIALS

Silliman's Journal, September 1870.—The opening article of this number is by Prof. E. Loomis, and is entitled "Comparison of the mean daily range of the Magnetic Declination, with the number of Auroras observed each year, and the extent of the black spots on the surface of the Sun." The author first discusses the observations of sun-spots, and points out some corrections that should be made in the numbers obtained by astronomers in the last century; he points out that the period is one of ten years and is influenced by the heliocentric conjunctions of Jupiter and Saturn, but affected by the conjunctions of the Earth and Venus. By a series of tables and curves the coincidences of periods of the maximum number of sun-spots with the maxima of magnetic disturbance and auroral display are elucidated, from which it appears that the present year is a period of maximum.—In a letter to the editors, Mr. J. W. French proposes *a new period in chronology called the Precession Period*, of 25,782 years, being the time for the precession of the equinoxes. The author prefers this period, since it is founded solely on astronomical facts.—The third article is by F. W. Clarke, "On the atomic volumes of solid compounds," in which are discussed the relations of the volumes of analogous and similarly constituted bodies.—The next article, "Considerations on the apparent inequalities of long periods in the mean motion of the Moon," is by Simon Newcomb, and, after a long discussion on the observations on this subject, and the theories proposed to explain them, the author attributes the phenomenon to an irregularity in the rotation of the crust of the earth, caused by the motion of its fluid contents.—The following is a very interesting article by Dr. A. M. Mayer on "Researches in Electro-magnetism." The author has devised a very accurate method of determining the relative values of electro-magnets to replace the one usually employed, which consists of measuring the deflection of a magnetic needle which is produced by the action of the electro-magnet. The author found that this process was liable to error in consequence of the difficulty of keeping the current absolutely constant, resulting in a continual motion of the needle. These difficulties were obviated in the following manner: A line eight feet long and divided into fractions of inches was drawn on a table, the latter being so placed that the line was at right angles to the magnetic meridian; a compass, with a needle nearly six inches long, was placed on this line, and a helix was fixed at each extremity of the line. These helices were traversed by the same current, a tangent galvanometer being placed in the circuit. In this way the needle was influenced by two magnets acting in opposite directions and excited by the same current, and if any deflection of the needle was observed, it must have been due to a difference of power of the magnets. If this occurred the needle might be brought to 0° by moving it from the stronger magnet. A series of experiments was made

to determine the variation of the intensity of the force with a change of distance, by placing the needle opposite an electro-magnet and noting the deflection produced when the instruments were at different distances from one another: it was found that in the apparatus employed the intensity varied inversely as the 2·7404 power of the distance from the core. Dr. Mayer has determined the power of cores made of insulated and of non-insulated soft iron wires, and finds that the insulated core is slightly the weaker. He has also measured what thickness of tube is equal to a solid core of the same diameter, and has found that a solid cylinder ten inches long and 1·68 in diameter may be replaced by a tube of the same length and of a thickness of $\frac{1}{8}$ of the diameter. This relative size does not appear to be constant for cores of all dimensions. A longitudinal slit in the tube does not diminish its power; in fact, Dr. Mayer seems inclined to think that it facilitates its magnetisation. By placing a helix inside a soft iron tube a magnet is produced with poles the reverse of those of the coil, or of a bar placed within the helix; this supports Ampère's theory of magnetic currents. Numerous other experiments are detailed in this paper, and the author promises to employ his apparatus for the determination of the force of magnets of different sizes.—Mr. G. F. Barker contributes an abstract of the second series of Professor Meissner's researches on electrised oxygen, in which are detailed the author's experiments on the substance formed simultaneously with ozone which possesses the property of producing a white mist in contact with water. The original paper was published by the Göttingen Royal Society of Sciences.—Mr. A. E. Verrill describes a new species of Entozoön from the Hog. This is followed by some notes on the structure of the Crinoidea, Cystidea, and Blastoidea, by E. Billings, F.G.S.—The next article consists of contributions to chemistry from the laboratory of the Lawrence Scientific School, the first paper of which is by W. G. Leison, on the precipitation and determination of the metals of the magnesium group in the form of oxalates. For this purpose the solutions containing the metals are mixed with oxalic acid and alcohol, the precipitated oxalates washed, dried, and dissolved in hydrochloric or sulphuric acid, and the quantity of oxalic acid present estimated by means of a standard solution of potassic permanganate. A number of examples show the accuracy of the process.—J. H. Talbott describes the precipitation of zinc and manganese as sulphides, and the quantitative separation of tin and tungsten by fusing with potassic cyanide, by which the tin is reduced to the metallic state.—A new mode of treating gelatinous precipitates is suggested by T. M. Chatard, which consists in evaporating the liquid containing the precipitate to dryness, and stirring until the mass becomes a dry powder, which is then readily washed on a filter.—S. P. Sharples points out that antimonious sulphide precipitated by sulphuretted hydrogen in boiling solutions is granular and easily washed. Arsenious sulphide does not behave in a similar manner.—In the fifth section B. Godwin advises the repetition of quantitative analyses with the same quantity of material, the mean of the results being taken.—The next article is by Professor W. A. Morton on the corona seen in total eclipses. He calls the attention of astronomers to the importance of determining the positions of the more prominent portions of the corona with reference to the equator of the sun.—Dr. Finlay contributes observations on prehistoric archæology in Greece.—The remainder of the journal consists of extracts from other journals principally European.

THE *Geological Magazine* for December (No. 78) opens with a curious paper on Earthquakes, written about the year 1798 by Sir John Prestwich, an ancestor of the President of the Geological Society. This paper is interesting not only as showing the absurdities which passed as science not much more than seventy years ago, but also as giving a list, derived from old historical works, of the occurrence of earthquakes in England.—The most important article in the number is a continuation of Mr. H. Woodward's Contributions to the Knowledge of British Fossil Crustacea, containing descriptions of species of the curious genus *Cyclus* from the British Carboniferous rocks. Many of the species are described as new, and most of them are well figured. There is also an interesting article by Mr. George Maw, on Recent Changes of Level in the Coastline of the Mediterranean; and Mr. J. F. Walker describes and figures some *Brachiopoda*, from the Lower Greensand of Upware in Cambridgeshire, two of them as new species. Other papers are: "On the Age and Position of the Blue Clay in the West of England," by Miss C. Eyton; and "On the Dispersion of Granite Blocks over the Plain of Cumberland," by Mr. D. Mackintosh.

THE most important paper in the *American Naturalist* for November is one presented by Prof. Agassiz to the Troy meeting of the American Association for the Advancement of Science, "On the former existence of local glaciers in the White Mountains." He conclusively shows that whatever may have been the number of its higher peaks which at any given time during the glacial period rose above the great ice-sheets that then covered the country, this mountain range offered no obstacle to the southward movement and progress of the northern ice-fields. To the north of the White Mountains, as well as to the south, the northern drift consists of a paste more or less clayey or sandy, containing abraded fragments of a great variety of rocks, so impacted into the minutely comminuted materials as to indicate neither stratification, arrangement, nor sorting, determined by the form, size, or weight of these fragments. Large boulders and pebbles of all sizes are found in it throughout its thickness, and these coarser materials have evidently been ground together with the clay and sand under great pressure, beneath heavy masses of ice; for they have all the characteristic marks so unmistakeable now to those who are familiar with glacial action, scratches, grooves, furrows, &c. We have also articles "On the Habits and Migrations of some of the Marine Fishes of Massachusetts," by J. H. Blake; "What is the Washington Eagle?" and "On the Distribution of the Moose in New England," by J. A. Allen; "Notes on certain Inland Birds of New Jersey," by Dr. C. C. Abbott; and two reprints, "On the Cultivation of Alpine Flowers," and "Acclimatisation of Foreign Trees," both from the *Quarterly Journal of Science*, by Mr. A. W. Bennett. Further abstracts are also given of papers read at the recent meeting of the American Association for the Advancement of Science.

SOCIETIES AND ACADEMIES

LONDON

Royal Geographical Society, December 13.—Sir H. Bartle Frere, vice-president, in the chair. The following new fellows were elected:—Daniel David Dymes; Colonel T. G. Glover, R.E.; R. M. Gordon; Captain L. W. Longstaff, Edward Masterman, jun.; Don Pompeio Moneta (Chief Engineer Argentine Republic), Charles Pannel; Alfred Robinson; G. S. T. Scobell; and C. A. Winchester.—Lieutenant G. C. Musters, R.N., read a paper on his recent journey through Patagonia, from the Straits of Magellan to the frontier of the Argentine Republic. The author, having determined on this journey, landed at the Chilian penal settlement of Punta Arena, in the Straits, on the 15th April, 1869, and, having procured the goodwill of the governor, was permitted to accompany a party who were despatched across the country to recover some runaway convicts at the mouth of the River Santa Cruz. Here he made a friendly arrangement with Orkeke, the cacique of a tribe of Patagonians, to traverse the country with them as far as the Rio Negro. He studied their language and manners, and joined them in their hunting parties: the country abounding in game, chiefly guanaco, the three-toed ostrich, and the puma, or American lion, the latter of which was eaten as well as the rest. Frozen rivers and heavy snow-falls prevented their starting from Santa Cruz before the 12th of August. They travelled at first in a westerly direction, until reaching the foot of the Cordilleras, along which they marched for upwards of 700 miles to the upper waters of the Rio Negro, making a short, but important, detour across the River Limay, in the Cordillera due east of Valdovia. The author described the streams crossed throughout the route, the physical nature of the country, and its chief productions, and gave also long and most interesting details of the manners of the wild tribes, including an account of hostile encounters with other tribes. He stated that, when not excited, the Patagonians manifested a good-tempered and generous disposition, and that they were remarkable for their affection to their wives and children. The women have the whole charge of the tents, constructed of poles and guanaco skins, and the march of many months was an almost continuous chase after the game of the country. Every morning the chief gave his orders for the day in a set speech. The men, on starting, spread themselves over a wide space in the plains, in a crescent form, the more advanced of whom on each side, travelling fastest, as the whole cavalcade moves on, meet in front, and thus enclose the game in a circle; the women and children, with the baggage-horses, forming the base line of the crescent. In the earlier part of the journey four such marches were made in succession, averaging

eight or ten miles each; then followed a rest of several days, in places where pasture was abundant. Lieutenant Musters was altogether more than a year with the tribe, who had come to look upon him as one of themselves. In May 1870 he crossed the country again from west to east, and on the 21st of that month arrived at the Argentine settlement of Patagonia, near the mouth of the Rio Negro. The climate of the country, in which he reached north of 40° S. lat., he describes as cold and ungenial; snow fell at midsummer, and the greatest heat experienced in the warmer months was only 65°.

Geological Society, December 7.—Mr. Joseph Prestwich, F.R.S., president, in the chair.—1. "On Fossils from Cradock and elsewhere in South Africa." By Dr. George Grey. From the Karoo-beds, Dicynodont fossils and the jaw of a reptile (*Estheriæ*), and some coal and coal-plants (*Lepidodendron*, *Sigillaria*, &c.), were the chief specimens noticed by the author. Some *Stigmariæ* from the Old Coal of Lower Albany, and gravel and miscellaneous minerals from the diamond fields, formed part of the collection. 2. "On some Points in South African Geology," Part II. By Mr. G. W. Stow. This paper commenced with a detailed account of the forest zones, coal, and other strata of the Karoo formation, as seen in sections in the Winterberg and Stormberg. The author particularly pointed out the position of the fern-beds at Dordrecht, of the Reptilian remains found on the Upper Zwartkei, and of the coal on the Klass Smits River. He next referred to the climatal changes of South Africa, as indicated by its geology and fossils, particularly the Karoo-beds, the *Enon* conglomerate, the *Trigonia*-beds, the several Post Tertiary shell-beds, and especially the present surface conditions, which he regarded as due to ice-action, as evidence of which he adduces *roches moutonnées*, moraines, basins, and striæ, both north and south of the Stormberg, in British Kaffraria, and even in Lower Albany. He concluded with remarks on the probable succession of periods, and on the former existence of a great southern continent. Prof. Ramsay expressed a hope that the author at some future time would discuss the numerous subjects of which he treated at greater length and under separate heads. He was not surprised at the finding of Carboniferous plants in the Dicynodont beds which appeared to be of Triassic age, inasmuch as the same was the case to some extent in our own later beds of Oolitic date. He agreed in the view of the probability of a vast continent having formerly existed in the southern part of the world, and considered that the denudation of Southern Africa had been so great, that it was no wonder the boundaries of the old freshwater lakes were no longer easy to find. It was also by no means surprising to him that a recurrence of glacial phenomena should be found in Southern Africa, as it had been in Europe. He did not, however, think it necessary to call in the action of ice for the excavation of valleys such as some of those described, as rain and running water appeared to him sufficiently powerful for the purpose. At the same time he would not deny the possibility of ice having been the agent in these cases. Mr. R. Tate had seen evidence of similar effects being produced by aqueous force to those resulting from glacial action, and cited instances of moraine-like deposits having been formed by running streams in Central and Southern America. Mr. H. Woodward suggested that it would be desirable to wait for further particulars of the sections before asuming the actual association of the *Lepidodendron* and other plants. He added that the *Stigmaria* lately said to have been obtained from the Kimmeridge clay, had really come originally from Newcastle. Prof. T. Rupert Jones remarked that Mr. Stow, like other South African geologists, had had ample experience of the effects of violent rain. With regard to the mixture of Palæozoic plants, such as the *Lepidodendron*, &c., sent by Dr. Grey with *Palæozamia* and *Pecopteris*, he thought it somewhat analogous to the mixture of palæozoic and mesozoic fossils in Australia. 3. "On the Geology of Natal, in South Africa." By Mr. C. L. Griesbach. The author commenced by describing the physical geography of Natal, and then indicated the characters and distribution of the rocks which occur in that country. He stated that the granitic and gneissic rocks do not form the most prominent elevations, but they appear chiefly in the lower parts of the river-valleys, and sometimes in small hills. Mica-schists and slates are found associated with the granites. The great plateaux consist of an undisturbed sandstone, which the author identifies with the Table-mountain sandstone, and which lies horizontally upon the granites and old slates. The tops of many of the table-mountains in Natal are crowned by beds of dark basaltic greenstone. The Karoo formation, which lies in part upon the Table-mountain sandstone, consists of a vast series of sandstones and shales, some of the latter containing beds of coal. The author agreed with Mr. Tate in regarding these beds as of Triassic age. At the base of the Karoo formation the author described a boulder-bed, which he was inclined to identify with the rock described by Mr. Bain as "Claystone porphyry," and through this greenstone has forced its way. On and near the coast of the southern part of Natal, some sandy marls and sandstones belonging to the Cretaceous series were said to occur; the author gave lists of fossils obtained from these deposits, which he identified with the Trichinopoly series of India. Several of the fossils were described as new species. The author considered that the evidence adduced indicated that, after the development of the Table-mountain sandstone, Africa and India formed parts of one continuous continent, afterwards covered by the Cretacous sea. The area now covered by the Indian Ocean was the basin of a large series of lakes; and this condition persisted through a long period of tranquillity, lasting through the Triassic to the Upper Jurassic age. The greater part of this continent was then depressed and covered by the shallow Cretaceous sea. The economic mineral products of Natal were mentioned by the author, who referred to the occurrence of graphite, coal, gold, and copper. Prof. T. Rupert Jones commented on the importance of the paper as throwing so complete a light on the geology of Natal, and proving the geological sequence to be similar there to that in other parts of Southern Africa. He remarked that the author had done special service by the great increase of information furnished by him regarding the Cretaceous rocks of Natal, and their equivalence to those of India. He also pointed out that Mr. Griesbach had proved that the Karoo formation was continuous to the other side of the great dividing range, and formed the floor of the Orange and Waal Valleys, and that as Mr. Stow had indicated glacial action on the south side of the Orange Valley, it was quite possible that the gravels containing the diamonds were of local origin, as Dr. Grey had suggested. 4. "On the Diamond-Districts of the Cape of Good Hope." By Mr. G. Gilfillan. Mr. Gilfillan described his going through Colesberg to Hopetown, and thence across the Orange River to Backhouse; and then, after crossing the Vaal, up its right bank as far as Lekatlong. He noticed such diamonds as he saw or heard of, and described the locality as being thickly coated with sand, diamond-bearing gravel, and tufa, hard blue shales occurring here and there in protruding hills. Prof. Tennant stated that he had lately seen as many as 500 diamonds from the South African fields in the possession of one person, some weighing as much as 50 carats. He had seen another fragment of a stone which must have originally been at least as large as the Koh-i-noor.

Ethnological Society, December 13.—Professor Huxley, president, in the chair. Mr. E. Rowley Morris was announced as a new member. Mr. Grove, Q.C., exhibited a dozen skulls from a large collection in the crypt of Rothwell Church, in Northamptonshire; and Professor Busk, F.R.S., made some remarks upon their anatomical peculiarities. The skulls are, on an average, smaller than those of the existing race, and many exhibit an extreme lowness of forehead. Some of them are referable to Prof. Huxley's "river-bed" type. The discussion on these remarks was sustained by the President, Mr. Galton, and Mr. Evans.—Sir John Lubbock, Bart., read a paper "On Stone Implements from Africa," in which he described some implements of the spear-head type from the Cape of Good Hope, and some small polished celts brought by Mr. Reed from near Accra on the Gold Coast. He also exhibited a small, but exquisitely-worked flint implement found in Syria. Mr. A. W. Franks, Mr. W. Blackmore, Mr. E. B. Tylor, Mr. J. W. Flower, Mr. Hyde Clarke, and Mr. E. B. Pusey, took part in the discussion on Sir John Lubbock's paper.—A collection of stone implements was exhibited by Dr. Hooker, C.B.—Some notes from Mr. Edgar Layard were read relative to some stone spear-heads, hammers, flakes, cores, &c., from South Africa.—A second report "On the Present Condition of the Prehistoric Antiquities of Dartmoor," was presented to the Society by Mr. C. Spence Bate, F.R.S. The author described in detail several stone circles, bee-hive huts, and avenues on the south of Dartmoor, especially in the neighbourhood of the Avon and the Erme. On Trowlsworthy Tor is a curious circular enclosure, with two entrances so constructed as to admit only a single man at a time, which the author regards as a specimen of early military engineering.

Linnean Society, December 15.—Mr. Bentham, president, in the chair. Dr. J. Lindsay Stewart was elected a member of

the council in the room of the late Dr. Anderson. — "On Sabadilla (*Asagræa officinalis* Lindl.) from Caracas," by A. Ernst. A large quantity of this drug is exported from Caracas and Venezuela, amounting to from 3,000 to 3,500 quintals annually, almost the whole being sent to Hamburg. The plant is a very common one by the roadsides in Caracas, but the greatest part of the drug (obtained from the seeds of the plant) comes from the hilly regions in the south, where it grows at an elevation of from 3,500 to 4,000 feet. It was originally discovered in the Mexican Andes, and is not known elsewhere. Although not mentioned by Humboldt, it is, however, apparently indigenous in Venezuela, growing in places where it is most unlikely to have been planted, and having been known long before the seeds were first exported by German druggists. The Caracasian plant differs slightly, but hardly specifically, from the typical form of Mexico. The bulbs contain numerous raphides of oxalate of lime.—"On the Pitcher-plant of California (*Darlingtonia*)," by W. Robinson, F.L.S. The Californian Pitcher-plants grow in the Sierra Nevada, at an altitude of 5,000 feet above the sea, in small sloping bogs along with *Sphagnum* and other true bog-plants. At a distance the pitchers have the appearance of jargonelle pears, holding their larger ends uppermost, at a distance of from 10 in. to 24 in. above the ground. This resulted from the pitchers being quite turned over at the top so as to form a full rounded dome, and the uppermost half of the pitcher being of a decided ripe pear-yellow. They are all twisted spirally, especially in their upper portion. Each pitcher had at the bottom a layer of from two to five inches of the remains of insects closely packed into it; from those of minute beetles to large feathery moths. What it is that attracts the insects is by no means clear. Pass a sharp knife through a lot of brown pitchers withering round an old plant, and the stumps resemble a number of tubes, densely packed with the remains of insects. Within the pitcher the surface is smooth for a little way down; then isolated hairs appear; and soon the chamber becomes densely lined with needle-like hairs, all pointing down, so decidedly indeed, that they almost lie against the surface from which they spring. These hairs are very slender, transparent, and about a quarter of an inch long, but have a needle-like rigidity, and are perfectly colourless. The poor flies, moths, ladybirds, &c., seem to travel down these conveniently arranged stubbles, but none seem to turn back. The pitcher, which may be a couple of inches wider at the top, narrows very gradually, and at its base is about a line in diameter. Here, and for some little distance above this point, the vegetable needles, of course, all converge, and the unhappy fly goes on till he finds his head against the thick firm bottom of the cell, and his rear against myriads of bayonets; and here he dies. Very small creatures fill up the narrow base, and above them larger ones densely pack themselves to death in the hope of fighting their way out. When held with the top upwards; sometimes a reddish juice, with an exceedingly offensive odour, drops from them. The plant is closely allied to the *Sarracenia*, and would no doubt be easily grown in this country.—"On Carnivorous and Insectivorus Plants," by Mrs. Barber (Cape Town).

NORWICH

Norfolk and Norwich Naturalists' Society, Nov. 29.—The Rev. J. Bates delivered a lecture on "Sun-spots," illustrated by numerous diagrams. After explaining the various and changing appearances presented by sun-spots and faculæ, and the electrical disturbances in the earth's atmosphere which accompanies them, Mr. Bates briefly reviewed the theories which have been advanced from time to time to account for these remarkable phenomena, and concluded by explaining the wonderful light spectrum analysis has thrown, not only upon the composition of the sun itself, but even upon the atmosphere by which it is surrounded, and the stupendous commotions by which it is constantly agitated.—Mr. Barrett read a paper "On certain coast insects found near Brandon." In June last Mr. Barrett captured at Brandon several species of moths, whose habitat was essentially coast sand-hills, and which he believes were not suspected to exist at any considerable distance from the sea. The nearest sea-coast to this locality would be upwards of twenty miles distant, and delicate insects such as the tiny *Gelechia desertella* and the weakly constructed *Auerastia lotella* would not voluntarily undertake so long a flight, and it is impossible, considering their frailness and the nature of the intervening country, to admit of their having been "blown across" to their present locality. Mr. Barrett therefore submits that as this tract of country was undoubtedly a range of coast sand late in the post-glacial period, when the great valley of the Fens was still submerged. These little insects are probably the descendants of an ancient race which has survived the physical changes of ages, and that possibly their very weakness has preserved them in a locality now far removed from what is considered their natural habitat. The specimens exhibited were identical in appearance with duplicates obtained from the coast, and the only difference observed in their habits was their earlier appearance, about a fortnight before the coast specimens, doubtless due to the warmer and more sheltered locality. Mr. Barrett's paper was followed by a discussion, in which some curious facts bearing upon his theory were elicited, amongst others the nesting of a coast species of bird (*Charadrius hiaticula*), in the same tract of country, these birds having, as it were, two distinct places of existence, one portion nesting on the sea beach far away, the other frequenting the ancient coast line which may have formed their breeding place countless ages ago. Seals found living in the Caspian Sea, in which the waters are only one-fifth the saltness of the open sea, are identical with those found in the North Sea and probably in the Mediterranean. Another species found in Lake Baikal, which is fresh water, is also found on the American coast. These, it was contended, were descendants of the oceanic seals, left by the subsidence of the water after the glacial period.—The President read some notes on the birds of New Zealand, from a letter recently received by him from his brother at New Plymouth, Taranaki. Speaking of the disappearance of small birds, which has been attributed to injuries inflected upon them by the bees on which they are supposed to have fed, and which have increased enormously, his correspondent altogether discountenanced the idea, attributing their disappearance to the disturbances of war, bush fires, and perhaps climatal changes. He adds: "I suspect that terrestrial commotions have altered our climate; since our last great earthquake, our winds have altered in their intensity, frequency, and direction. Report states that there has been a great disruption of Antarctic ice, which to me explains the frequency of penguins, mostly young, being among the rocks here, and the capture of two sorts of seals, the common seal and seal lion, both young, quite close to the town, though they have never been seen here since this was a settlement. The natives say they were common enough before the Europeans came, and they still call certain rocks on the beach by the names of the sort of seal that once frequented them. Some of the birds, however, appear to be returning to their former haunts.

GLASGOW

Geological Society, December 1.—Mr. John Young, vice-president, in the chair. *Bituminous Striped Sandstone.*—The chairman exhibited a block of carboniferous sandstone from Gilmorehill quarry, about nine inches in thickness, showing in that space thirty-two well-defined alternate white and dark-brown stripes, which gave the specimen a beautifully stratified appearance. Mr. Young stated that the brown stripes were due to the particles of sand having become mixed with bituminous matter previous to their deposition. *Carboniferous Fossils.*—Mr. Thomas Naismyth exhibited several drawers of fish remains, principally from the coal-fields around Glasgow, upon which Mr. Young offered a few remarks illustrative of their generic characters and their range in the carboniferous strata. The collection contained a number of fine large teeth of *Rhizodus Hibberti*, from the ironstone pits at Possil; jaws, scales, and teeth of *Megalichthys Hibberti* and *Megalichthys rugosus*, besides a number of fin-spines and other fragments of fishes, from the Airdrie coal-field. Among the specimens were also to be noticed a few fragments of reptilian remains, consisting of portions of crania, vertebræ, &c., which had been found near Airdrie, and at Quarter, near Hamilton. *Oil Shale.*—Mr. D. C. Glen, C.E., laid before the meeting several slabs of oil shale from near Collingwood, on Lake Huron, Canada; and also some samples of the petroleum distilled from it. The slabs were from the Silurian formation, which is of great extent in North America, and remarkable for the regular succession of its strata. When examined, these blocks of shale were found to be stratified horizontally with layers of Trilobites, Entomostraca, and other marine organisms. It was from the prodigious abundance of these crustaceans over this track of ancient sea-bottom that the shales now referred to had received their bituminous ingredients.

PERTH

Perthshire Society of Natural Science, December 2.—Dr. Buchanan White, president, in the chair. Mr. W. Herd exhibited two specimens (♂ and ♀) of *Dasypolia templi*, recently

found by him near Perth. Intimation was given that the first number of the *Scottish Naturalist*, a quarterly magazine of natural history, published under the auspices of the Society, and supported by most of the leading Scottish naturalists, would appear early in January.—Mr. J. Sadler, F.R.P.S.E. (of Edinburgh), read a paper "On the Geographical Distribution of Plants in Perthshire." He traced the range of various characteristic plants from the sea-level up to the summit of Ben Lawers, the highest mountain in the county, and pointed out the distribution of the rarer species in other parts of Britain. In reference to *Saxifraga cernua*, which in Britain has only been found on the summit of Ben Lawers, Mr. Sadler said that in the opinion of some botanists the Ben Lawers plant was only an Alpine form of *Saxifraga granulata*, but in his opinion it was a good species. The paper was illustrated by an interesting series of diagrams, formed of dried specimens of the plants. One of these diagrams showed the altitude attained by the various plants found on Ben Lawers from its base to its summit.—The President read a paper upon "A Naturalist's Work in Winter." He divided his subject into two divisions, "Out-door Work" and "In-door Work," and pointed out what could be and should be done in the various branches of natural history during the winter months.

PHILADELPHIA

Natural Sciences Society, July 5.—The president, Dr. Ruschenberger, in the chair. Mr. Meehan exhibited some specimens of *Rumex obtusifolius*, a naturalised dock from Europe. He said that so far as he could ascertain from European specimens, and the descriptions of Babington, Bromfield, and other English botanists, the plant was there hermaphrodite; but here, as correctly stated by Dr. Asa Gray, it was monœciously polygamous. He thought the fact that plants hermaphrodite in one country becoming unisexual in another, was worthy of more attention by those engaged in the study of the laws of sex than had been given to it. This *Rumex* did not stand alone; *R. crispus* and *R. patienta* exhibited the same thing. *Fragaria* was another instance well known to horticulturists, although the fact scientifically had not received due weight. The average tendency of the strawberry in Europe was to hermaphrodism—here to produce pistillate forms. He also called attention to the fact that in these American specimens unisexuality was in proportion to axial vigour. This law he had already explained in times past to the Academy, and new instances were scarcely necessary. Here, however, the moderately weak plant had more hermaphrodite flowers than the strong one; and in both classes of specimens the number of male flowers gradually increased with the weakening of the axis, until the ends of the raceme were almost wholly of male flowers. The first flowers on the strong verticels were usually wholly pistillate. Prof. Leidy remarked that the interesting communication of Mr. Meehan had recalled to his mind a result of his experience, which he thought would accord with that of others, viz., that species viewed as common to both Europe and America frequently exhibit slight peculiarities, which are distinctive of those of the two countries. It is what might be inferred even if we admit the evolution of existing species from a common remote ancestry. A wide separation, with a considerable lapse of time and a modification of circumstances, are sufficient to account for the slight and acquired differences. Even where differences are not observed in form and structure, they may exist in the habit of the species. Thus the common wolf of Europe and America, viewed by many naturalists as of the same species, differs strikingly in character in the two countries. In the former it is a more fearless animal, not hesitating to attack man; in the latter, it is said never to attack man. At an early period observers saw, or thought they saw, many of the same species of plants and animals indigenous to America that occur in Europe, and hence the common names of European species were applied to those of America. Gradually the list of species common to the two countries was much reduced, and now is comparatively small.

August 2.—Mr. Vaux, Vice-president, in the chair. Mr. Thomas Meehan called attention to the arrangements of some plants for preventing fertilisation through any other than insect agency, as discovered by Darwin. The *Salvia* family of plants had the most elaborate arrangements for insect agency, but it had been objected to Darwin's theory that insects made no use of them. Bees bore holes through the tube from the outside for the honey, and do not enter by the mouth of the flower, as they ought. In the same way, in the *Petunia*, bees bore for honey from the outside. He had discovered that in these cases, where day insects failed to make use of these apparatuses, fertilisation was carried on by night moths, so that the objections to Darwinism were removed. He also referred to the common sweet chestnut, as bearing two classes of male flowers, only one of which probably aided in fertilisation. The first class appeared ten days before the other, and are those which give whiteness to the trees. They appear in the axils of the weak shoots. The female flowers appear on the apices of strong shoots, according to his theory of the laws of sex. The second class of male flowers appears at the ends of the vigorous shoots bearing the female flowers. Whatever affects the vigour of the tree interferes with the production of female but not of male flowers, and this was the reason why some seasons had short crops.

BOOKS RECEIVED

ENGLISH.—Text-books of Science: Inorganic Chemistry: W. A. Miller, M.D. (Longmans and Co.).—Method and Medicine, an Essay: B. W. Foster (Churchill).—Science, Creeds, and Scripture, and the Mystery of God: (Blackwood and Sons).—A Laboratory Text-book of Practical Chemistry: W. G. Valentin (Churchill).

FOREIGN.—(Through Williams and Norgate)—Theoretische Astronomie: Dr. W. Klinkerfues.—Handbuch der allgemeinen Himmelsbeschreibung: H. J. Klein.

PAMPHLETS RECEIVED

The Education and Status of Civil Engineers (published by the Institution).—Spectrum Analysis: a Lecture by W. Huggins.—Spectrum Analysis: a Lecture by Prof. Roscoe.—Coral and Coral-reefs: a Lecture by Prof. Huxley.—Proceedings of the Annual Meeting of the Natural History Society of Montreal.—Proceedings of the Cleveland Institution of Engineers.—Science Education abroad: a Lecture by Principal Dawson.—Description of New Fossil Shells of the Upper Amazon: T. A. Conrad.—On the Heat developed in the combination of Acids and Bases: Dr. Thomas Andrews.—New Remedies: Dr. M'Elroy.—Provisional Catalogue of Transactions of Societies, Periodicals, and Memoirs in the Radcliffe Library.—Essay on the Comparative Efficiency of Spectroscopic Prisms of different Angles: E. C. Pickering.—Abstracts relating to the Preservation of Food: W. H. Archer.—Experiments on the Transpiration of Watery Fluid by Leaves: W. R. McNab, M.D.—Applicazione della teoria Darwiniana ai fiori ed agli insetti visitatori dei fiori: F. Delpino.

DIARY

THURSDAY, DECEMBER 22.

ROYAL, at 8.30.—Actinometrical Observations made at Dehra Doon and Mussoorie, in India: Lieut. Hennessey.—On the Constitution of the Solid Crust of the Earth: Archdeacon Pratt, F.R.S.—On the Extension of the Coalfields of England beneath the Newer Formations, and the Successive Physical Changes whereby they have been reduced to their present Dimensions: E. Hull, F.R.S.

FRIDAY, DECEMBER 23.

QUEKETT MICROSCOPICAL SOCIETY, at 8.

TUESDAY, DECEMBER 27.

ROYAL INSTITUTION, at 3.—Burning and Unburning: Prof. Odling (juvenile lectures).

THURSDAY, DECEMBER 29.

ROYAL INSTITUTION, at 3.—Burning and Unburning: Prof. Odling.

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ERRATUM.—Page 94, first column, line 2 from bottom, for "*aqueteus*" read "*aquaticus*."